Schweitzer Engineering Laboratories, Inc.

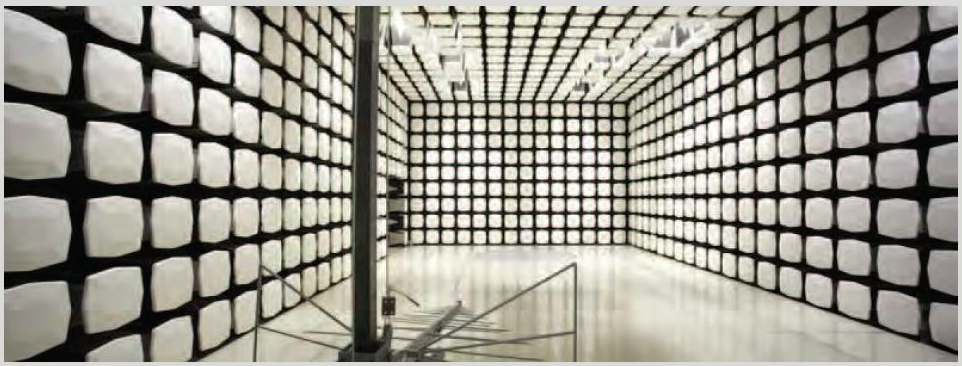
SEL-3031R – Rack Mount

FCC 15.247:2022, RSS-247 Issue 2:2017;

RSS-Gen Issue 5:2018+A1:2019+A2:2021

902 - 928 MHz FHSS Transceiver

Report: SCHW0252.3, Issue Date: January 10, 2023



ACCREDITED
CERT #3310.02

CERTIFICATE OF TEST

Last Date of Test: December 7, 2022
Schweitzer Engineering Laboratories, Inc.
EUT: SEL-3031R

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2022	ANSI C63.10:2013, FCC KDB 558074 v05r02:2019
FCC 15.247:2022	
RSS-247 Issue 2:2017, RSS-Gen Issue 5:2018+A1:2019+A2:2021	

Results

Test Description	Result	FCC Section(s)	RSS Section(s)	ANSI C63.10 Section(s)	Comments
Powerline Conducted Emissions (Transmitter)	Pass	15.207	RSS-Gen 8.8	6.2	
Spurious Radiated Emissions	Pass	15.247(d)	RSS-247 5.5	6.5, 6.6	
Duty Cycle	Pass	15.247	RSS-Gen 3.2	7.5	
Carrier Frequency Separation	Pass	15.247(a)(1)	RSS-247 5.1(b)	7.8.2	
Number of Hopping Frequencies	Pass	15.247(a)(1)	RSS-247 5.1(d)	7.8.3	
Dwell Time	Pass	15.247(a)(1)	RSS-247 5.1(d)	7.8.4	
Equivalent Isotropic Radiated Power (EIRP)	Pass	15.247(b)	RSS-247 5.4(d)	7.8.5	
Output Power	Pass	15.247(b)	RSS-247 5.4(d)	7.8.5	
Band Edge Compliance	Pass	15.247(d)	RSS-247 5.5	7.8.6	
Band Edge Compliance - Hopping Mode	Pass	15.247(d)	RSS-247 5.5	7.8.6	
Emissions Bandwidth (dB)	Pass	15.247(a)	RSS-247 5.2(a)	7.8.7	
Occupied Bandwidth (99%)	Pass	15.247(a)	RSS-Gen 6.7	7.8.7	
Spurious Conducted Emissions	Pass	15.247(d)	RSS-247 5.5	7.8.8	
Power Spectral Density	N/A	15.247(e)	RSS-247 5.2(b)	11.10.2	Not required for FHSS devices.
Powerline Conducted Emissions (Receiver)	N/A	15.101, 15.107	RSS-Gen 5.2	ANSI C63.4 - 12.2.4	Not included per FCC 15.101 as this will be covered under SDoC rules for the FCC. RSS-Gen section 7 stated receiver requirements only apply to standalone receivers operating in

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

CERTIFICATE OF TEST

					the 30-960 MHz band and this is not a standalone receiver.
Radiated Emissions for Receiver	N/A	15.101, 15.109	RSS-Gen 5.2	ANSI C63.4 - 12.2.5	Not included per FCC 15.101 as this will be covered under SDoC rules for the FCC. RSS-Gen section 7 stated receiver requirements only apply to standalone receivers operating in the 30-960 MHz band and this is not a standalone receiver.

Deviations From Test Standards

None

Approved By:

Cole Ghizzone, Department Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

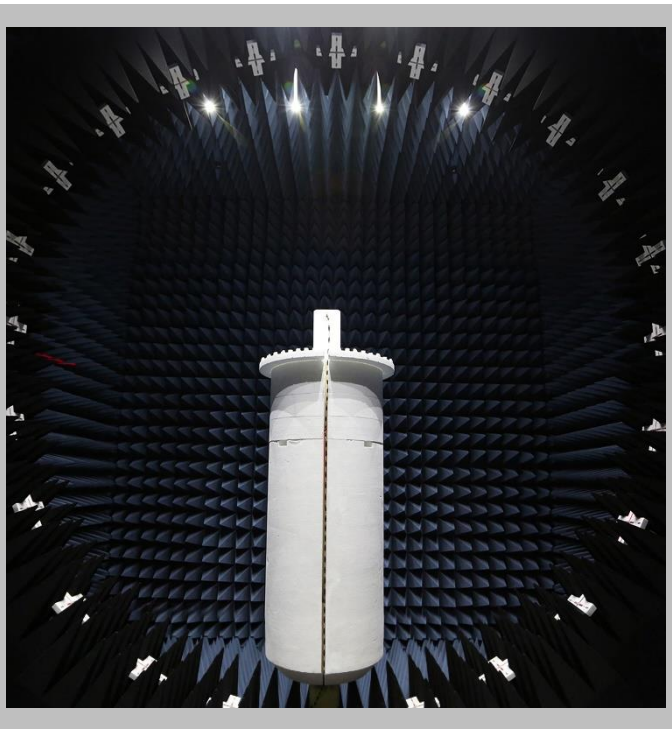
For details on the Scopes of our Accreditations, please visit:

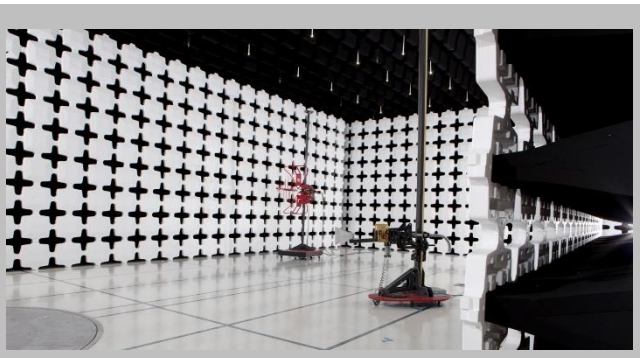
California Minnesota Oregon Texas Washington

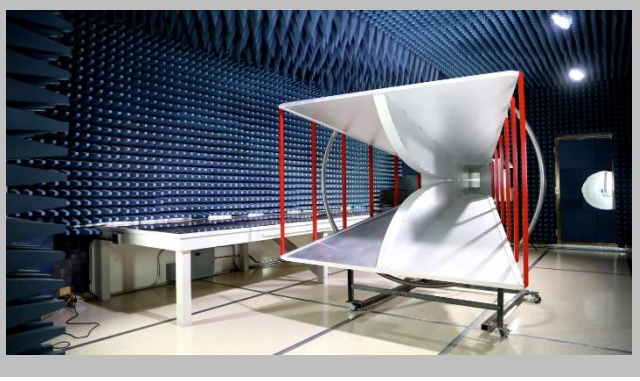
FACILITIES

element
2020.12.15

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	3.2 dB	-3.2 dB

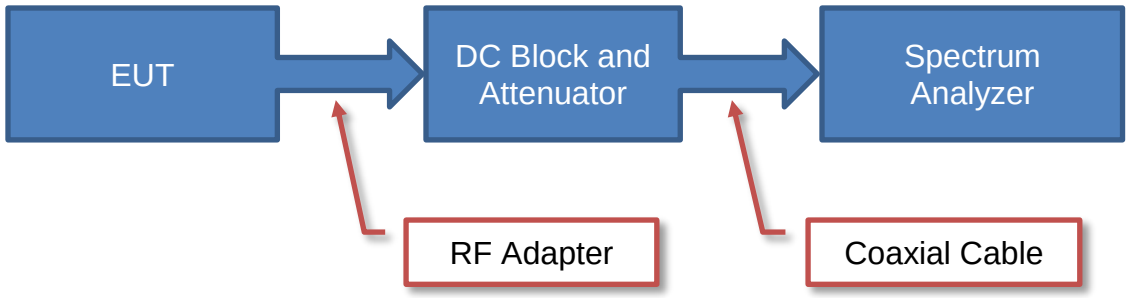
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

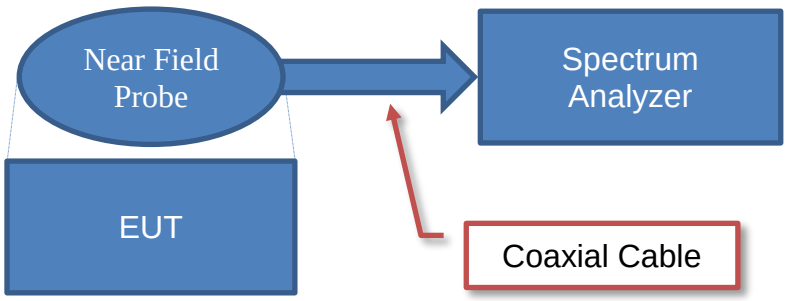
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

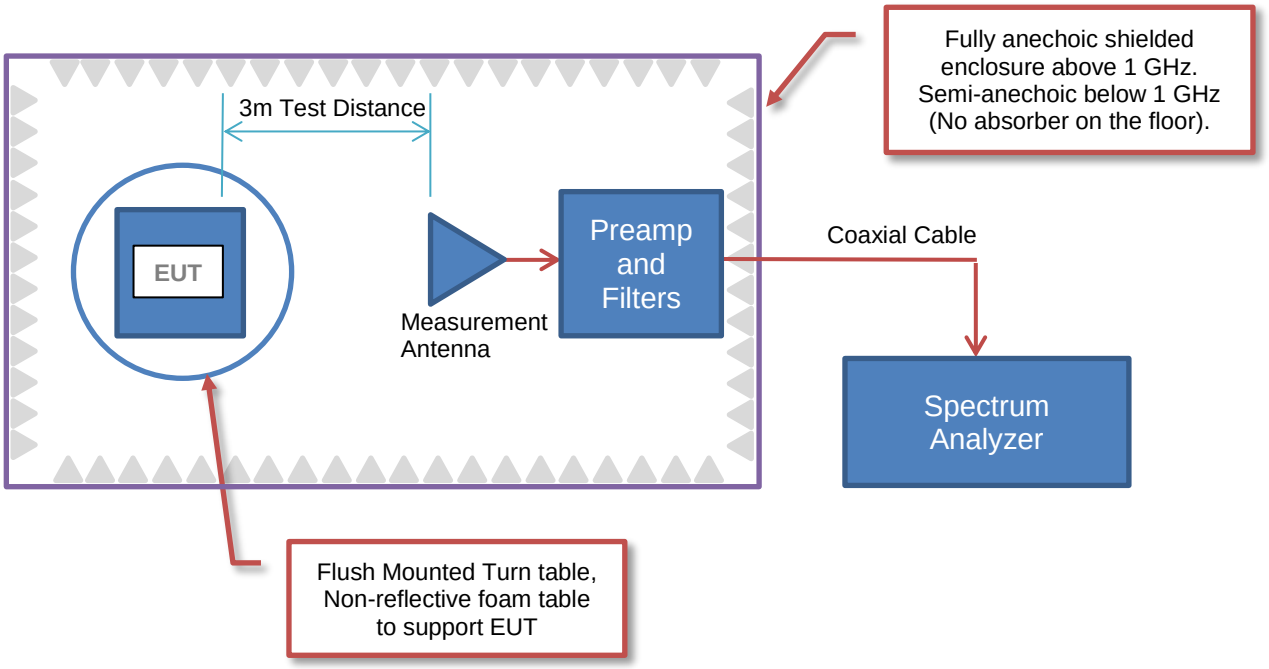


Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)		Factor: Antenna Factor		Factor: Cable Factor		Factor: Amplifier Gain		Distance Adjustment Factor		External Attenuation		Field Strength
42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0	=	**33.5**

Conducted Emissions:

Measured Level (Amplitude)		Factor: Transducer Factor		Factor: Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

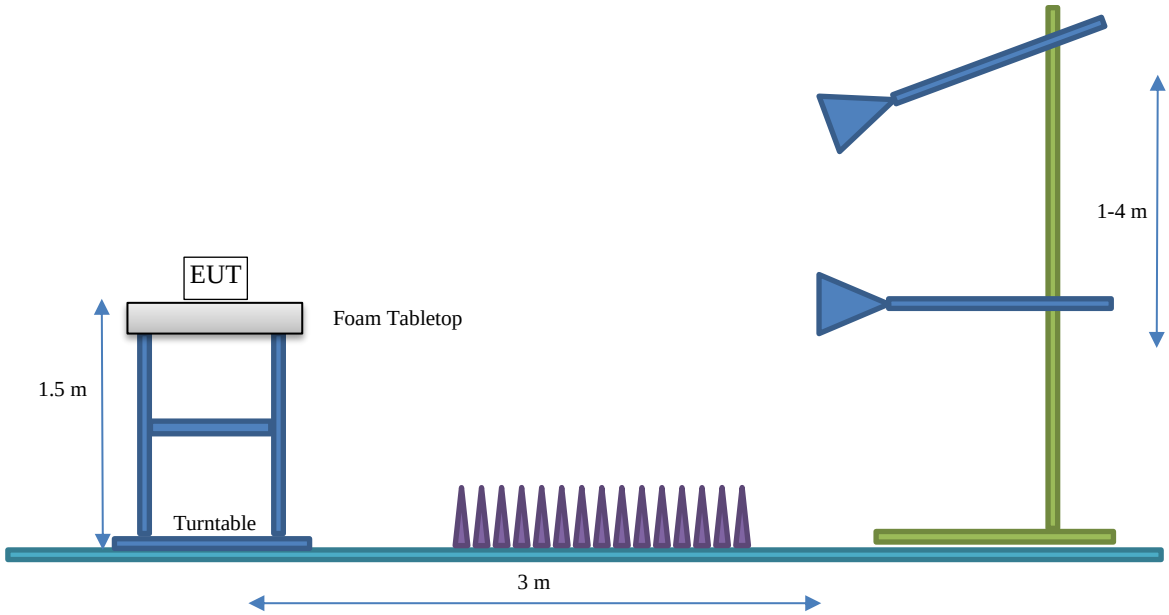
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	Schweitzer Engineering Laboratories, Inc.
Address:	13518 E Indiana Ave
City, State, Zip:	Spokane Valley, WA 99216
Test Requested By:	Erik Floden
EUT:	SEL-3031R
First Date of Test:	December 5, 2022
Last Date of Test:	December 7, 2022
Receipt Date of Samples:	December 5, 2022
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
FHSS Radio - rack mounted

Testing Objective:
Seeking to demonstrate compliance in the 902 - 928 MHz band for operation under FCC 15.247:2022. To demonstrate compliance to RSS-247 Issue 2:2017, RSS-Gen Issue 5:2018+A1:2019+A2:2021 specifications under technology category Frequency Hopping - Other.

POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
Yagi	PCTEL	890 - 960	14.15
½ wave dipole	PCTEL	902 - 928	9.15

The EUT was tested using the power settings provided by the manufacturer which were based upon:

☐ Test software settings Test software/firmware installed on EUT: SEL-3031-R104-V0-Z003001-D20111228
X Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types	Power Mode	Position (if multiple channels)	Frequency (MHz)	Power Setting dBm
GFSK / 200 kbps	High	Low Channel	902.6	30
		Mid Channel	915.2	
		High Channel	927.5	
	Low	Low Channel	902.6	20
		Mid Channel	915.2	
		High Channel	927.5	

CONFIGURATIONS

Configuration SCHW0252- 1

Software/Firmware Running During Test	
Description	**Version**
TeraTerm	4.84
Firmware	SEL-3031-R104-V0-Z003001-D20111228
FPGA	SEL-3031-R101-D20101018

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Radio PCB	Schweitzer Engineering Laboratories, Inc.	B5033	A17830492
Main PCB	Schweitzer Engineering Laboratories, Inc.	B5004	A18076732

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
15 VDC Power Supply	Schweitzer Engineering Laboratories, Inc.	SEL-9322	None
Laptop	Dell	Precision 3551	4XPX3F3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Power	No	2.5 m	No	Serial Radio Transceiver	15 VDC Power Supply
AC Power	No	1.8 m	No	15 VDC Power Supply	AC Power
USB	Yes	2.0 m	No	Serial Radio Transceiver	Unterminated

CONFIGURATIONS

Configuration SCHW0252- 4

Software/Firmware Running During Test	
Description	**Version**
TeraTerm	4.84
Firmware	SEL-3031-R104-V0-Z003001-D20111228
FPGA	SEL-3031-R101-D20101018

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Dipole	PCTEL	MFB9157NF	None
Serial Radio Transceiver	Schweitzer Engineering Laboratories, Inc.	SEL-3031R	1223080495

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Precision 3551	4XPX3F3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	2.0 m	No	Serial Radio Transceiver	Unterminated
3x DB9	Yes	2.5 m	No	Serial Radio Transceiver	Unterminated
Alarm	No	2.5 m	No	Serial Radio Transceiver	Unterminated
AC Power	No	1.8 m	No	Serial Radio Transceiver	AC Power

CONFIGURATIONS

Configuration SCHW0252- 5

Software/Firmware Running During Test	
Description	**Version**
TeraTerm	4.84
Firmware	SEL-3031-R104-V0-Z003001-D20111228
FPGA	SEL-3031-R101-D20101018

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Yagi	PCTEL	BMYD890M	None
Serial Radio Transceiver	Schweitzer Engineering Laboratories, Inc.	SEL-3031R	1223080495

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Precision 3551	4XPX3F3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	2.0 m	No	Serial Radio Transceiver	Unterminated
3x DB9	Yes	2.5 m	No	Serial Radio Transceiver	Unterminated
Alarm	No	2.5 m	No	Serial Radio Transceiver	Unterminated
AC Power	No	1.8 m	No	Serial Radio Transceiver	AC Power

CONFIGURATIONS

Configuration SCHW0252- 7

Software/Firmware Running During Test	
Description	**Version**
TeraTerm	4.84
Firmware	SEL-3031-R104-V0-Z003001-D20111228
FPGA	SEL-3031-R101-D20101018

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Serial Radio Transceiver	Schweitzer Engineering Laboratories, Inc.	SEL-3031R	1223080495

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Precision 3551	4XPX3F3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	2.0 m	No	Serial Radio Transceiver	Unterminated
3x DB9	Yes	2.5 m	No	Serial Radio Transceiver	Unterminated
Alarm	No	2.5 m	No	Serial Radio Transceiver	Unterminated
AC Power	No	1.8 m	No	Serial Radio Transceiver	AC Power

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2022-12-05	Powerline Conducted Emissions (Transmitter)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2022-12-05	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2022-12-05	Carrier Frequency Separation	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2022-12-05	Number of Hopping Frequencies	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2022-12-05	Dwell Time	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2022-12-05	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2022-12-05	Equivalent Isotropic Radiated Power (EIRP)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2022-12-05	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
9	2022-12-05	Band Edge Compliance - Hopping Mode	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
10	2022-12-05	Emissions Bandwidth (dB)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
11	2022-12-05	Occupied Bandwidth (99%)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
12	2022-12-05	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
13	2022-12-06	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
14	2022-12-07	Spurious Radiated Emissions - Conducted	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Gauss Instruments	TDEMI 30M	ARN	2022-04-20	2023-04-20
Cable - Conducted Cable Assembly	Northwest EMC	EVG, HHD, RKT	EVGA	2022-01-04	2023-01-04
LISN	Solar Electronics	9252-50-R-24-BNC	LIP	2022-09-08	2023-09-08

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	3.2 dB	-3.2 dB

CONFIGURATIONS INVESTIGATED

SCHW0252-4
SCHW0252-5

MODES INVESTIGATED

Tx - High power, Mid Ch = 915.2 MHz

POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

EUT:	SEL-3031R	Work Order:	SCHW0252
Serial Number:	1223080495	Date:	2022-12-05
Customer:	Schweitzer Engineering Laboratories, Inc.	Temperature:	20.7°C
Attendees:	Erik Floden	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure (PMSL):	1019 mb
Tested By:	Jeff Alcoke	Job Site:	EV07
Power:	15 VDC via 110VAC/60Hz	Configuration:	SCHW0252-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	10	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

None

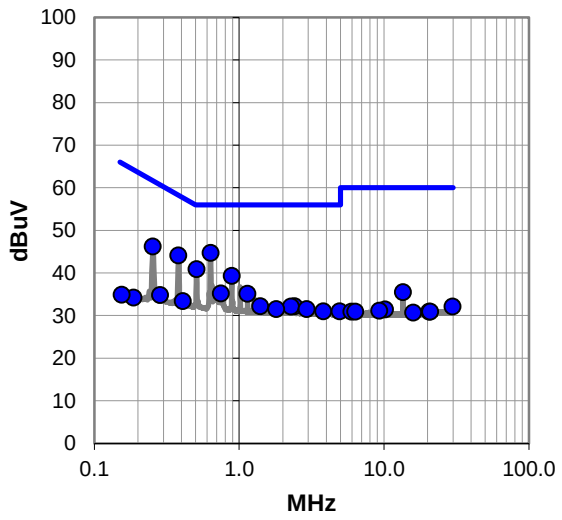
EUT OPERATING MODES

Tx - High Power, Mid Ch = 915.2 MHz

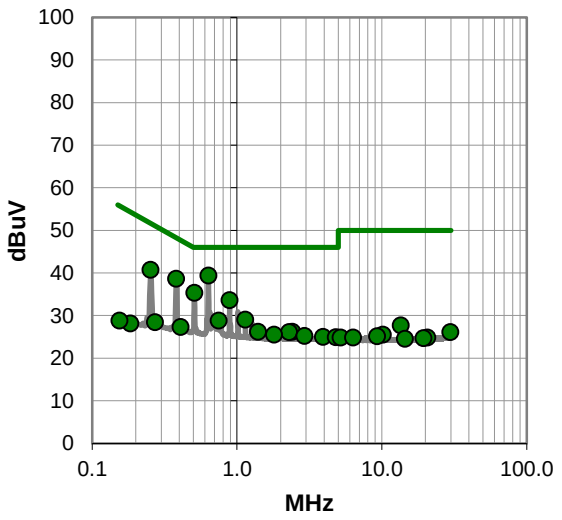
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

RESULTS - Run #10

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.635	25.0	19.7	44.7	56.0	-11.3
0.380	24.3	19.8	44.1	58.3	-14.2
0.509	21.2	19.7	40.9	56.0	-15.1
0.254	26.3	19.9	46.2	61.6	-15.4
0.888	19.5	19.8	39.3	56.0	-16.7
0.747	15.4	19.8	35.2	56.0	-20.8
1.142	15.3	19.8	35.1	56.0	-20.9
1.397	12.4	19.8	32.2	56.0	-23.8
2.411	12.2	20.0	32.2	56.0	-23.8
2.285	12.1	20.0	32.1	56.0	-23.9
0.409	13.6	19.8	33.4	57.7	-24.3
1.804	11.6	19.9	31.5	56.0	-24.5
2.919	11.5	20.0	31.5	56.0	-24.5
13.562	15.2	20.3	35.5	60.0	-24.5
3.807	11.0	20.0	31.0	56.0	-25.0
4.950	10.9	20.1	31.0	56.0	-25.0
0.284	14.9	19.9	34.8	60.7	-25.9
29.743	11.0	21.1	32.1	60.0	-27.9
10.156	11.1	20.3	31.4	60.0	-28.6
9.268	10.9	20.2	31.1	60.0	-28.9
5.966	10.8	20.1	30.9	60.0	-29.1
6.349	10.8	20.1	30.9	60.0	-29.1
20.565	10.2	20.7	30.9	60.0	-29.1
20.817	10.2	20.7	30.9	60.0	-29.1
15.898	10.2	20.5	30.7	60.0	-29.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.635	19.7	19.7	39.4	46.0	-6.6
0.380	18.8	19.8	38.6	48.3	-9.7
0.509	15.6	19.7	35.3	46.0	-10.7
0.254	20.8	19.9	40.7	51.6	-10.9
0.888	13.8	19.8	33.6	46.0	-12.4
1.143	9.2	19.8	29.0	46.0	-17.0
0.747	9.0	19.8	28.8	46.0	-17.2
1.397	6.4	19.8	26.2	46.0	-19.8
2.413	6.2	20.0	26.2	46.0	-19.8
2.286	6.1	20.0	26.1	46.0	-19.9
0.409	7.5	19.8	27.3	47.7	-20.4
1.802	5.6	19.9	25.5	46.0	-20.5
2.919	5.2	20.0	25.2	46.0	-20.8
3.936	5.0	20.0	25.0	46.0	-21.0
4.824	4.8	20.1	24.9	46.0	-21.1
13.562	7.4	20.3	27.7	50.0	-22.3
0.272	8.5	19.9	28.4	51.1	-22.7
29.743	5.0	21.1	26.1	50.0	-23.9
10.156	5.2	20.3	25.5	50.0	-24.5
9.268	4.9	20.2	25.1	50.0	-24.9
5.207	4.7	20.1	24.8	50.0	-25.2
6.348	4.7	20.1	24.8	50.0	-25.2
20.692	4.1	20.7	24.8	50.0	-25.2
19.421	4.1	20.6	24.7	50.0	-25.3
14.432	4.1	20.4	24.5	50.0	-25.5

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

EUT:	SEL-3031R	Work Order:	SCHW0252
Serial Number:	1223080495	Date:	2022-12-05
Customer:	Schweitzer Engineering Laboratories, Inc.	Temperature:	20.7°C
Attendees:	Erik Floden	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure (PMSL):	1019 mb
Tested By:	Jeff Alcoke	Job Site:	EV07
Power:	15 VDC via 110VAC/60Hz	Configuration:	SCHW0252-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	11	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

None

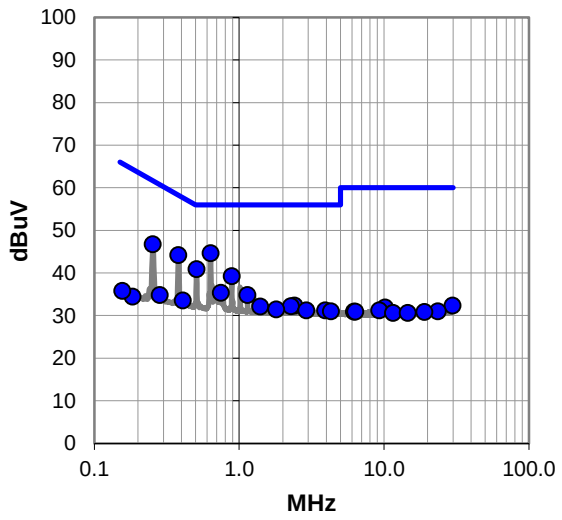
EUT OPERATING MODES

Tx - High Power, Mid Ch = 915.2 MHz

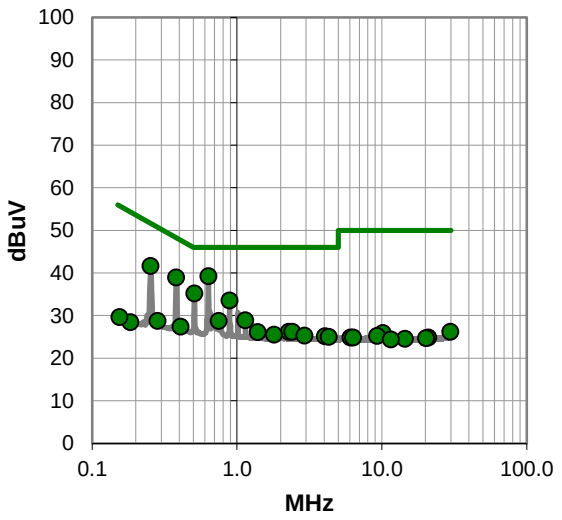
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

RESULTS - Run #11

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.635	24.9	19.7	44.6	56.0	-11.4
0.380	24.4	19.8	44.2	58.3	-14.1
0.254	26.8	19.9	46.7	61.6	-14.9
0.507	21.2	19.7	40.9	56.0	-15.1
0.888	19.4	19.8	39.2	56.0	-16.8
0.747	15.5	19.8	35.3	56.0	-20.7
1.143	15.0	19.8	34.8	56.0	-21.2
2.411	12.3	20.0	32.3	56.0	-23.7
2.285	12.2	20.0	32.2	56.0	-23.8
1.397	12.3	19.8	32.1	56.0	-23.9
0.409	13.7	19.8	33.5	57.7	-24.2
1.802	11.5	19.9	31.4	56.0	-24.6
2.918	11.2	20.0	31.2	56.0	-24.8
3.934	11.2	20.0	31.2	56.0	-24.8
4.314	11.0	20.0	31.0	56.0	-25.0
0.283	14.9	19.9	34.8	60.7	-25.9
29.746	11.2	21.1	32.3	60.0	-27.7
10.155	11.6	20.3	31.9	60.0	-28.1
9.267	11.0	20.2	31.2	60.0	-28.8
23.536	10.2	20.8	31.0	60.0	-29.0
6.220	10.8	20.1	30.9	60.0	-29.1
6.346	10.8	20.1	30.9	60.0	-29.1
19.036	10.2	20.6	30.8	60.0	-29.2
11.554	10.3	20.3	30.6	60.0	-29.4
14.595	10.2	20.4	30.6	60.0	-29.4

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.635	19.5	19.7	39.2	46.0	-6.8
0.380	19.1	19.8	38.9	48.3	-9.4
0.254	21.7	19.9	41.6	51.6	-10.0
0.507	15.5	19.7	35.2	46.0	-10.8
0.888	13.7	19.8	33.5	46.0	-12.5
1.142	9.1	19.8	28.9	46.0	-17.1
0.747	8.9	19.8	28.7	46.0	-17.3
2.285	6.2	20.0	26.2	46.0	-19.8
2.411	6.2	20.0	26.2	46.0	-19.8
1.395	6.3	19.8	26.1	46.0	-19.9
0.409	7.6	19.8	27.4	47.7	-20.3
1.802	5.6	19.9	25.5	46.0	-20.5
2.919	5.3	20.0	25.3	46.0	-20.7
4.062	5.1	20.0	25.1	46.0	-20.9
4.315	5.0	20.0	25.0	46.0	-21.0
0.283	8.8	19.9	28.7	50.7	-22.0
29.741	5.1	21.1	26.2	50.0	-23.8
10.155	5.6	20.3	25.9	50.0	-24.1
9.267	5.0	20.2	25.2	50.0	-24.8
6.091	4.7	20.1	24.8	50.0	-25.2
6.346	4.7	20.1	24.8	50.0	-25.2
20.939	4.1	20.7	24.8	50.0	-25.2
20.179	4.1	20.6	24.7	50.0	-25.3
14.473	4.1	20.4	24.5	50.0	-25.5
11.540	4.1	20.3	24.4	50.0	-25.6

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

EUT:	SEL-3031R	Work Order:	SCHW0252
Serial Number:	1223080495	Date:	2022-12-05
Customer:	Schweitzer Engineering Laboratories, Inc.	Temperature:	20.7°C
Attendees:	Erik Floden	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure (PMSL):	1019 mb
Tested By:	Jeff Alcoke	Job Site:	EV07
Power:	15 VDC via 110VAC/60Hz	Configuration:	SCHW0252-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	16	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

None

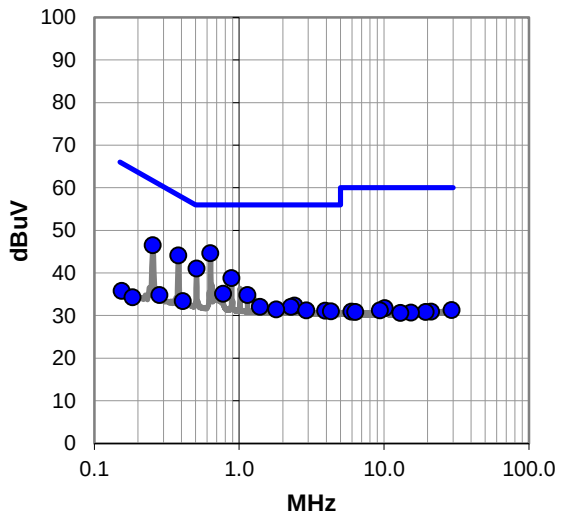
EUT OPERATING MODES

Tx - High power, Mid Ch = 915.2 MHz

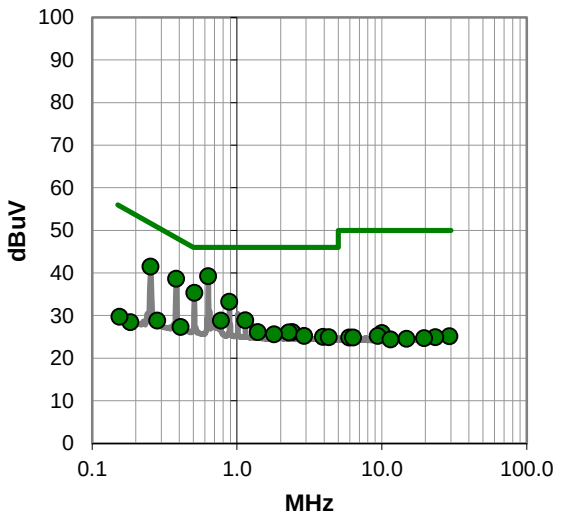
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

RESULTS - Run #16

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.634	24.9	19.7	44.6	56.0	-11.4
0.380	24.3	19.8	44.1	58.3	-14.2
0.507	21.3	19.7	41.0	56.0	-15.0
0.254	26.6	19.9	46.5	61.6	-15.1
0.887	19.0	19.8	38.8	56.0	-17.2
0.774	15.3	19.8	35.1	56.0	-20.9
1.142	15.0	19.8	34.8	56.0	-21.2
2.410	12.3	20.0	32.3	56.0	-23.7
1.394	12.2	19.8	32.0	56.0	-24.0
2.282	12.0	20.0	32.0	56.0	-24.0
0.409	13.6	19.8	33.4	57.7	-24.3
1.802	11.5	19.9	31.4	56.0	-24.6
2.916	11.2	20.0	31.2	56.0	-24.8
3.931	11.1	20.0	31.1	56.0	-24.9
4.312	11.0	20.0	31.0	56.0	-25.0
0.281	14.9	19.9	34.8	60.8	-26.0
10.144	11.4	20.3	31.7	60.0	-28.3
29.291	10.2	21.1	31.3	60.0	-28.7
9.384	11.0	20.2	31.2	60.0	-28.8
5.962	10.8	20.1	30.9	60.0	-29.1
21.139	10.2	20.7	30.9	60.0	-29.1
6.340	10.7	20.1	30.8	60.0	-29.2
19.392	10.2	20.6	30.8	60.0	-29.2
15.376	10.2	20.5	30.7	60.0	-29.3
12.988	10.3	20.3	30.6	60.0	-29.4

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.634	19.5	19.7	39.2	46.0	-6.8
0.380	18.8	19.8	38.6	48.3	-9.7
0.254	21.6	19.9	41.5	51.6	-10.1
0.507	15.6	19.7	35.3	46.0	-10.7
0.887	13.4	19.8	33.2	46.0	-12.8
1.142	9.1	19.8	28.9	46.0	-17.1
0.774	9.0	19.8	28.8	46.0	-17.2
1.395	6.3	19.8	26.1	46.0	-19.9
2.410	6.1	20.0	26.1	46.0	-19.9
2.282	6.0	20.0	26.0	46.0	-20.0
1.804	5.7	19.9	25.6	46.0	-20.4
0.408	7.5	19.8	27.3	47.7	-20.4
2.916	5.2	20.0	25.2	46.0	-20.8
3.929	5.0	20.0	25.0	46.0	-21.0
4.309	4.9	20.0	24.9	46.0	-21.1
0.281	8.9	19.9	28.8	50.8	-22.0
10.017	5.6	20.3	25.9	50.0	-24.1
9.384	5.0	20.2	25.2	50.0	-24.8
29.325	4.0	21.1	25.1	50.0	-24.9
23.437	4.1	20.8	24.9	50.0	-25.1
5.960	4.7	20.1	24.8	50.0	-25.2
6.340	4.7	20.1	24.8	50.0	-25.2
19.651	4.1	20.6	24.7	50.0	-25.3
14.850	4.0	20.5	24.5	50.0	-25.5
11.523	4.1	20.3	24.4	50.0	-25.6

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

EUT:	SEL-3031R	Work Order:	SCHW0252
Serial Number:	1223080495	Date:	2022-12-05
Customer:	Schweitzer Engineering Laboratories, Inc.	Temperature:	20.7°C
Attendees:	Erik Floden	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure (PMSL):	1019 mb
Tested By:	Jeff Alcoke	Job Site:	EV07
Power:	15 VDC via 110VAC/60Hz	Configuration:	SCHW0252-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	17	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

None

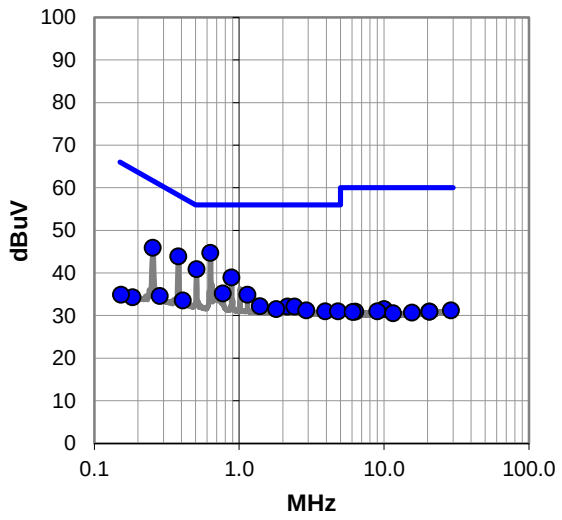
EUT OPERATING MODES

Tx - High power, Mid Ch = 915.2 MHz

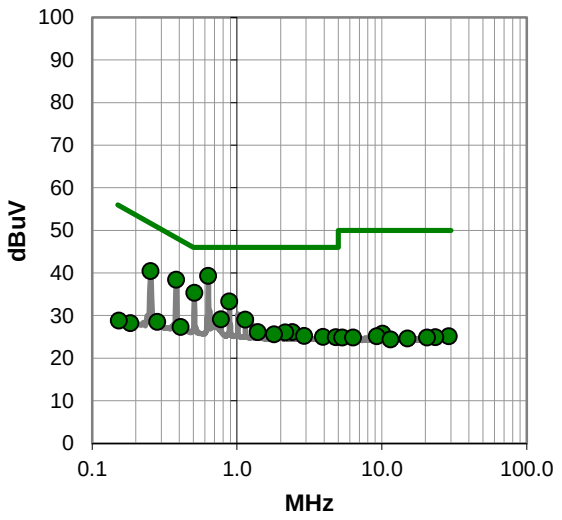
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS (TRANSMITTER)

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

RESULTS - Run #17

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.634	25.0	19.7	44.7	56.0	-11.3
0.380	24.1	19.8	43.9	58.3	-14.4
0.507	21.2	19.7	40.9	56.0	-15.1
0.254	26.0	19.9	45.9	61.6	-15.7
0.887	19.1	19.8	38.9	56.0	-17.1
0.773	15.4	19.8	35.2	56.0	-20.8
1.142	15.1	19.8	34.9	56.0	-21.1
1.395	12.4	19.8	32.2	56.0	-23.8
2.155	12.1	20.0	32.1	56.0	-23.9
2.408	12.1	20.0	32.1	56.0	-23.9
0.408	13.7	19.8	33.5	57.7	-24.2
1.802	11.6	19.9	31.5	56.0	-24.5
2.916	11.2	20.0	31.2	56.0	-24.8
3.931	11.0	20.0	31.0	56.0	-25.0
4.817	10.9	20.1	31.0	56.0	-25.0
0.283	14.7	19.9	34.6	60.7	-26.1
10.017	11.2	20.3	31.5	60.0	-28.5
29.056	10.1	21.1	31.2	60.0	-28.8
9.003	10.8	20.2	31.0	60.0	-29.0
6.339	10.8	20.1	30.9	60.0	-29.1
20.527	10.2	20.7	30.9	60.0	-29.1
20.661	10.2	20.7	30.9	60.0	-29.1
6.084	10.7	20.1	30.8	60.0	-29.2
15.629	10.2	20.5	30.7	60.0	-29.3
11.542	10.2	20.3	30.5	60.0	-29.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.634	19.6	19.7	39.3	46.0	-6.7
0.380	18.6	19.8	38.4	48.3	-9.9
0.507	15.6	19.7	35.3	46.0	-10.7
0.254	20.5	19.9	40.4	51.6	-11.2
0.887	13.5	19.8	33.3	46.0	-12.7
0.774	9.3	19.8	29.1	46.0	-16.9
1.142	9.2	19.8	29.0	46.0	-17.0
1.395	6.3	19.8	26.1	46.0	-19.9
2.408	6.1	20.0	26.1	46.0	-19.9
2.155	6.0	20.0	26.0	46.0	-20.0
1.804	5.7	19.9	25.6	46.0	-20.4
0.409	7.5	19.8	27.3	47.7	-20.4
2.916	5.2	20.0	25.2	46.0	-20.8
3.931	5.0	20.0	25.0	46.0	-21.0
4.817	4.8	20.1	24.9	46.0	-21.1
0.281	8.6	19.9	28.5	50.8	-22.3
10.143	5.4	20.3	25.7	50.0	-24.3
9.256	4.9	20.2	25.1	50.0	-24.9
29.026	4.0	21.1	25.1	50.0	-24.9
23.437	4.1	20.8	24.9	50.0	-25.1
5.326	4.7	20.1	24.8	50.0	-25.2
6.339	4.7	20.1	24.8	50.0	-25.2
20.527	4.1	20.7	24.8	50.0	-25.2
15.089	4.1	20.5	24.6	50.0	-25.4
11.525	4.1	20.3	24.4	50.0	-25.6

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies (in no-hop, single channel mode) and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp was used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10*log(1/dc).

RMS measurements taken for a FHSS radio also may have a duty cycle correction subtracted using the formula 10*log(DC), where DC is the worst-case dwell time of the radio while in a hopping mode in a 100 ms period.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2021-12-09	2022-12-09
Antenna - Biconilog	EMCO	3142B	AXJ	2021-03-03	2023-03-03
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	2022-03-02	2024-03-02
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2022-11-03	2023-11-03
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	2022-05-03	2023-05-03
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2022-11-03	2023-11-03
Cable	N/A	Bilog Cables	EVA	2022-11-03	2023-11-03
Cable	N/A	Double Ridge Horn Cables	EVB	2022-05-03	2023-05-03
Cable	None	Standard Gain Horn Cables	EVF	2022-11-03	2023-11-03
Filter – Low Pass	Micro-Tronics	LPM5004	LFD	2022-02-10	2023-02-10

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	5.2 dB	-5.2 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 10000 MHz

POWER INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

SCHW0252-7

MODES INVESTIGATED

Tx - Low Ch = 902.6 MHz, Mid Ch = 915.2 MHz, High Ch = 927.5 MHz

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

EUT:	SEL-3031R	Work Order:	SCHW0252
Serial Number:	1223080495	Date:	2022-12-06
Customer:	Schweitzer Engineering Laboratories, Inc.	Temperature:	19.7°C
Attendees:	Erik Floden	Relative Humidity:	36.5%
Customer Project:	None	Bar. Pressure (PMSL):	1023 mb
Tested By:	Jeff Alcoke	Job Site:	EV01
Power:	110VAC/60Hz	Configuration:	SCHW0252-7

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

TEST PARAMETERS

Run #:	19	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

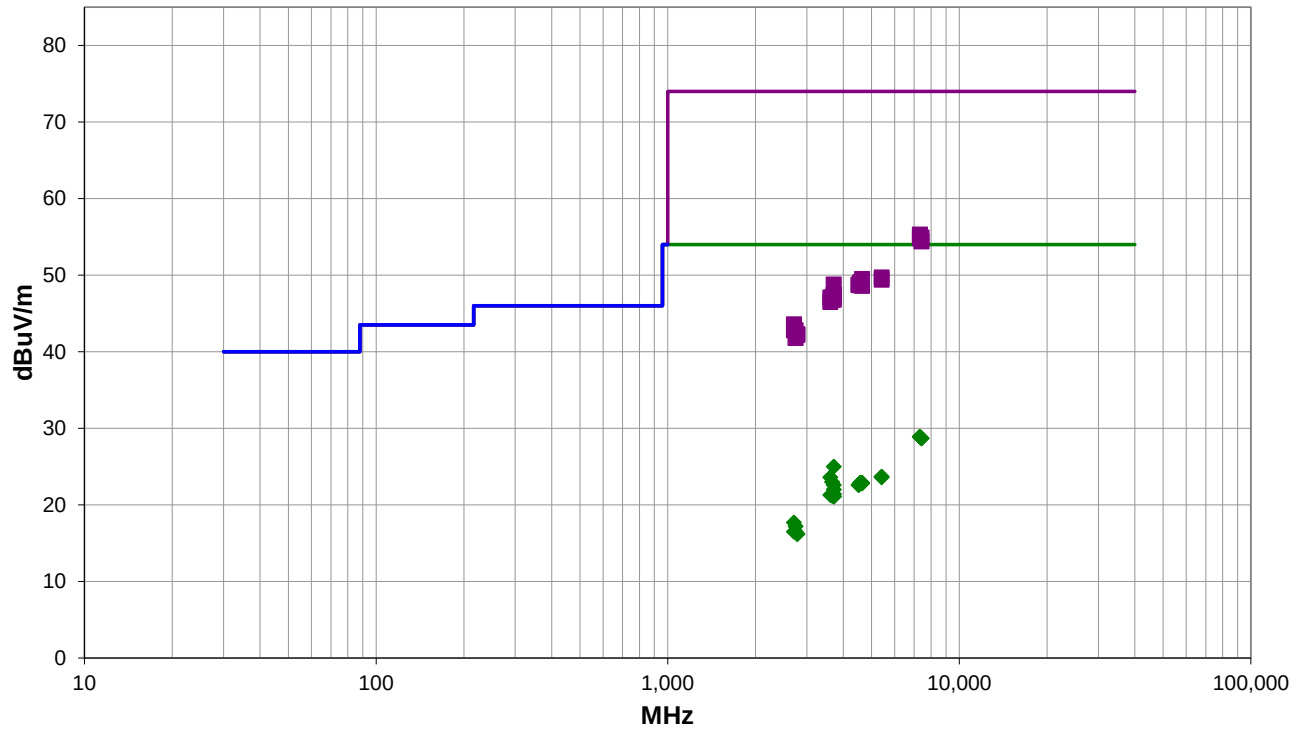
Test mode operates at 44% duty cycle, upward DCCF correction applied based on 10*log(1/Duty cycle) = 3.6 dB. When operating in FHSS mode, the worst-case transmission time over any 100 ms period is 1.4 ms. Downward DCCF correction applied based on 10*log(On Time/100 ms) = -18.5 dB. Total correction applied = -14.9 dB. Please reference data comments below for; Channel, EUT orientation, and power setting.

EUT OPERATING MODES

Tx - Low Ch = 902.6 MHz, Mid Ch = 915.2 MHz, High Ch = 927.5 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 19 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

RESULTS - Run #19

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azmuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7323.717	39.6	15.7	3.1	290.0	0.0	0.0	Vert	PK	0.0	55.3	74.0	-18.7	Mid Ch, EUT Horz, High Power
7422.075	38.9	16.0	3.7	0.0	0.0	0.0	Vert	PK	0.0	54.9	74.0	-19.1	High Ch, EUT Horz, High Power
7319.275	39.1	15.7	1.5	79.0	0.0	0.0	Horz	PK	0.0	54.8	74.0	-19.2	Mid Ch, EUT on Side, High Power
7418.367	38.4	16.0	1.5	50.0	0.0	0.0	Horz	PK	0.0	54.4	74.0	-19.6	High Ch, EUT on Side, High Power
5415.633	39.9	9.8	1.5	326.0	0.0	0.0	Horz	PK	0.0	49.7	74.0	-24.3	Low Ch, EUT on Side, High Power
4638.975	41.1	8.4	4.0	129.0	0.0	0.0	Vert	PK	0.0	49.5	74.0	-24.5	High Ch, EUT Horz, High Power
5415.892	39.6	9.8	1.5	186.0	0.0	0.0	Vert	PK	0.0	49.4	74.0	-24.6	Low Ch, EUT Horz, High Power
4578.225	40.8	8.3	1.5	41.0	0.0	0.0	Horz	PK	0.0	49.1	74.0	-24.9	Mid Ch, EUT on Side, High Power
4574.333	40.7	8.3	1.5	225.0	0.0	0.0	Vert	PK	0.0	49.0	74.0	-25.0	Mid Ch, EUT Horz, High Power
7320.817	28.1	15.7	1.5	79.0	-14.9	0.0	Horz	AV	0.0	28.9	54.0	-25.1	Mid Ch, EUT on Side, High Power
7319.517	28.1	15.7	3.1	290.0	-14.9	0.0	Vert	AV	0.0	28.9	54.0	-25.1	Mid Ch, EUT Horz, High Power
3710.450	43.0	5.8	2.6	170.0	0.0	0.0	Vert	PK	0.0	48.8	74.0	-25.2	High Ch, EUT Horz, High Power
4515.450	40.6	8.2	1.5	36.0	0.0	0.0	Horz	PK	0.0	48.8	74.0	-25.2	Low Ch, EUT on Side, High Power
7418.383	27.6	16.0	1.5	50.0	-14.9	0.0	Horz	AV	0.0	28.7	54.0	-25.3	High Ch, EUT on Side, High Power
7419.008	27.6	16.0	3.7	0.0	-14.9	0.0	Vert	AV	0.0	28.7	54.0	-25.3	High Ch, EUT Horz, High Power
4514.975	40.5	8.2	1.5	21.0	0.0	0.0	Vert	PK	0.0	48.7	74.0	-25.3	Low Ch, EUT Horz, High Power
4639.525	40.2	8.4	3.3	320.0	0.0	0.0	Horz	PK	0.0	48.6	74.0	-25.4	High Ch, EUT on Side, High Power
3710.417	41.6	5.8	1.5	294.0	0.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	High Ch, EUT on Side, High Power
3708.175	41.6	5.8	2.0	179.0	0.0	0.0	Vert	PK	0.0	47.4	74.0	-26.6	High Ch, EUT Vert, High Power
3710.125	41.4	5.8	1.5	115.0	0.0	0.0	Horz	PK	0.0	47.2	74.0	-26.8	High Ch, EUT Vert, High Power
3708.367	41.3	5.8	1.5	131.0	0.0	0.0	Vert	PK	0.0	47.1	74.0	-26.9	High Ch, EUT on Side, High Power
3610.525	41.6	5.5	2.4	155.0	0.0	0.0	Horz	PK	0.0	47.1	74.0	-26.9	Low Ch, EUT on Side, High Power
3660.417	41.6	5.5	4.0	220.0	0.0	0.0	Vert	PK	0.0	47.1	74.0	-26.9	Mid Ch, EUT Horz, High Power
3707.858	41.2	5.8	1.0	135.0	0.0	0.0	Horz	PK	0.0	47.0	74.0	-27.0	High Ch, EUT Horz, High Power
3659.483	41.3	5.5	1.5	321.0	0.0	0.0	Horz	PK	0.0	46.8	74.0	-27.2	Mid Ch, EUT on Side, High Power
3711.050	41.0	5.8	1.5	117.0	0.0	0.0	Horz	PK	0.0	46.8	74.0	-27.2	High Ch, EUT Horz, Low Power
3609.592	41.0	5.5	1.2	129.0	0.0	0.0	Vert	PK	0.0	46.5	74.0	-27.5	Low Ch, EUT Horz, High Power
3710.000	34.1	5.8	2.6	170.0	-14.9	0.0	Vert	AV	0.0	25.0	54.0	-29.0	High Ch, EUT Horz, High Power
5413.200	28.8	9.8	1.5	186.0	-14.9	0.0	Vert	AV	0.0	23.7	54.0	-30.3	Low Ch, EUT Horz, High Power
3610.458	33.0	5.5	2.4	155.0	-14.9	0.0	Horz	AV	0.0	23.6	54.0	-30.4	Low Ch, EUT on Side, High Power
5414.050	28.7	9.8	1.5	326.0	-14.9	0.0	Horz	AV	0.0	23.6	54.0	-30.4	Low Ch, EUT on Side, High Power
2710.175	43.5	0.1	1.1	139.0	0.0	0.0	Vert	PK	0.0	43.6	74.0	-30.4	Low Ch, EUT Horz, High Power
3660.925	32.4	5.5	4.0	220.0	-14.9	0.0	Vert	AV	0.0	23.0	54.0	-31.0	Mid Ch, EUT Horz, High Power
4639.983	29.4	8.4	3.3	320.0	-14.9	0.0	Horz	AV	0.0	22.9	54.0	-31.1	High Ch, EUT on Side, High Power
4578.183	29.5	8.3	1.5	41.0	-14.9	0.0	Horz	AV	0.0	22.9	54.0	-31.1	Mid Ch, EUT on Side, High Power
4578.225	29.5	8.3	1.5	225.0	-14.9	0.0	Vert	AV	0.0	22.9	54.0	-31.1	Mid Ch, EUT Horz, High Power
4639.892	29.3	8.4	4.0	129.0	-14.9	0.0	Vert	AV	0.0	22.8	54.0	-31.2	High Ch, EUT Horz, High Power
2745.708	42.6	0.2	1.5	125.0	0.0	0.0	Horz	PK	0.0	42.8	74.0	-31.2	Mid Ch, EUT on Side, High Power
2708.950	42.7	0.1	1.5	258.0	0.0	0.0	Horz	PK	0.0	42.8	74.0	-31.2	Low Ch, EUT on Side, High Power
3710.108	31.7	5.8	1.5	294.0	-14.9	0.0	Horz	AV	0.0	22.6	54.0	-31.4	High Ch, EUT on Side, High Power

SPURIOUS RADIATED EMISSIONS

element
WTD.2022.07.28.0
EmiR5 2022.07.06.0
PSA-ESCI 2022.08.23.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azmuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4515.275	29.3	8.2	1.5	36.0	-14.9	0.0	Horz	AV	0.0	22.6	54.0	-31.4	Low Ch, EUT on Side, High Power
4515.358	29.3	8.2	1.5	21.0	-14.9	0.0	Vert	AV	0.0	22.6	54.0	-31.4	Low Ch, EUT Horz, High Power
2783.517	42.1	0.2	1.5	0.0	0.0	0.0	Horz	PK	0.0	42.3	74.0	-31.7	High Ch, EUT on Side, High Power
2784.850	42.0	0.2	1.5	59.0	0.0	0.0	Vert	PK	0.0	42.2	74.0	-31.8	High Ch, EUT Horz, High Power
3710.117	31.1	5.8	1.0	135.0	-14.9	0.0	Horz	AV	0.0	22.0	54.0	-32.0	High Ch, EUT Horz, High Power
2743.175	41.6	0.2	2.9	217.0	0.0	0.0	Vert	PK	0.0	41.8	74.0	-32.2	Mid Ch, EUT Horz, High Power
3709.800	30.5	5.8	1.5	131.0	-14.9	0.0	Vert	AV	0.0	21.4	54.0	-32.6	High Ch, EUT on Side, High Power
3710.058	30.5	5.8	2.0	179.0	-14.9	0.0	Vert	AV	0.0	21.4	54.0	-32.6	High Ch, EUT Vert, High Power
3610.475	30.7	5.5	1.2	129.0	-14.9	0.0	Vert	AV	0.0	21.3	54.0	-32.7	Low Ch, EUT Horz, High Power
3660.783	30.6	5.5	1.5	321.0	-14.9	0.0	Horz	AV	0.0	21.2	54.0	-32.8	Mid Ch, EUT on Side, High Power
3712.492	30.2	5.8	1.5	115.0	-14.9	0.0	Horz	AV	0.0	21.1	54.0	-32.9	High Ch, EUT Vert, High Power
3712.358	30.2	5.8	1.5	117.0	-14.9	0.0	Horz	AV	0.0	21.1	54.0	-32.9	High Ch, EUT Horz, Low Power
2707.767	32.5	0.1	1.1	139.0	-14.9	0.0	Vert	AV	0.0	17.7	54.0	-36.3	Low Ch, EUT Horz, High Power
2745.575	31.9	0.2	1.5	125.0	-14.9	0.0	Horz	AV	0.0	17.2	54.0	-36.8	Mid Ch, EUT on Side, High Power
2707.842	31.3	0.1	1.5	258.0	-14.9	0.0	Horz	AV	0.0	16.5	54.0	-37.5	Low Ch, EUT on Side, High Power
2745.625	31.2	0.2	2.9	217.0	-14.9	0.0	Vert	AV	0.0	16.5	54.0	-37.5	Mid Ch, EUT Horz, High Power
2782.183	30.9	0.2	1.5	0.0	-14.9	0.0	Horz	AV	0.0	16.2	54.0	-37.8	High Ch, EUT on Side, High Power
2782.375	30.9	0.2	1.5	59.0	-14.9	0.0	Vert	AV	0.0	16.2	54.0	-37.8	High Ch, EUT Horz, High Power

CONCLUSION

Pass

Tested By

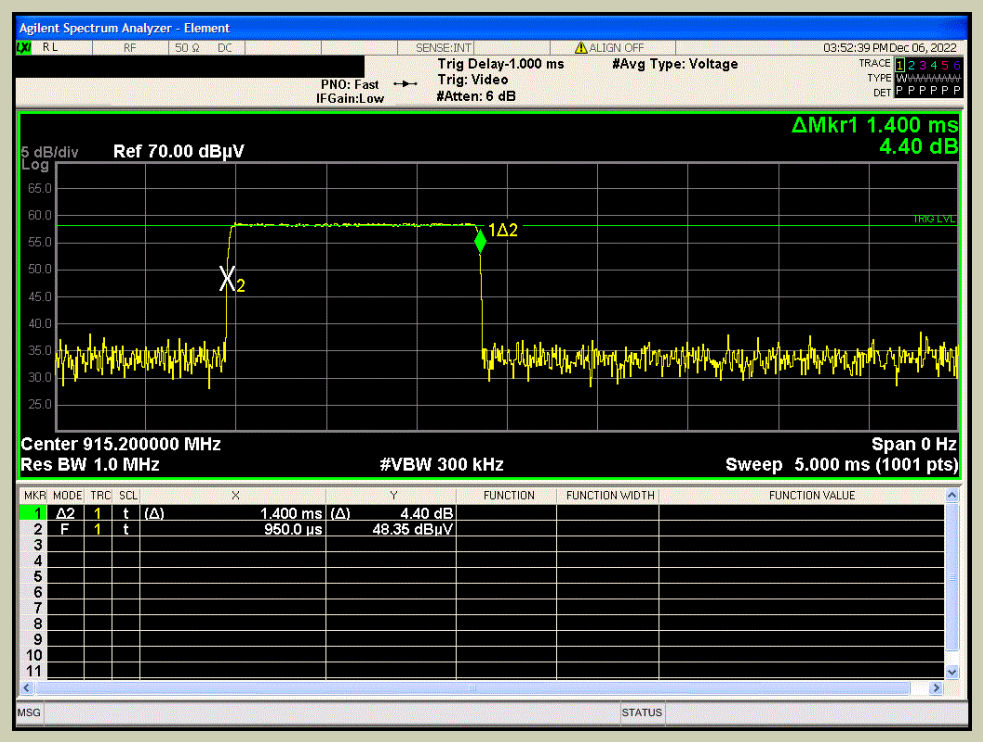


Figure 1 - Hopping mode, pulse width

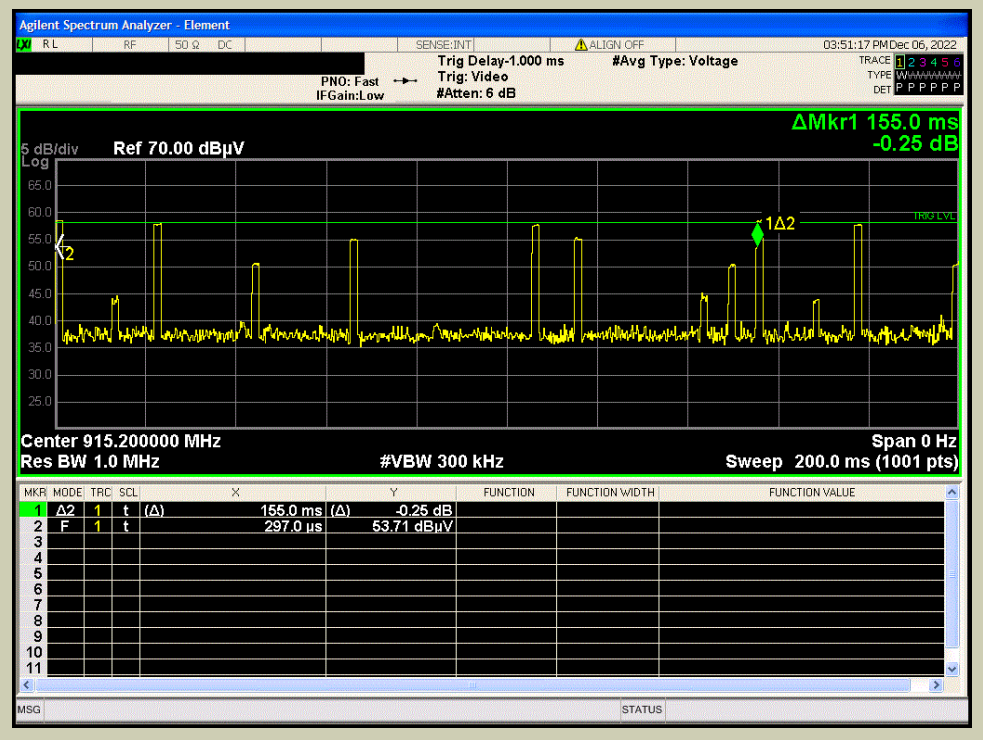


Figure 2 - Hopping mode, period

SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	S.M. Electronics	SA26B-6	AUX	2022-03-15	2023-03-15
Filter - Band Pass/Notch	K&L Microwave	3TNF-500/1000-N/N	HFT	2022-10-25	2023-10-25
Filter - High Pass	Micro-Tronics	HPM50108	HFV	2022-11-03	2023-11-03
Filter - Low Pass	Micro-Tronics	LPM50003	LFB	2022-02-10	2023-02-10
Cable	N/A	EVK, EVI cables	EVO	2022-12-07	2023-12-07
Generator - Signal	Agilent	N5183A	TID	2021-05-04	2023-05-04
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFI	2021-12-09	2022-12-09

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the spectrum was measured with a 100 kHz RBW for frequencies between 30 MHz and 1 GHz and a 1 MHz RBW for frequencies above 1 GHz. The VBW was set to be 3 times as large as the RBW.

The conducted output power at each frequency within a restricted band was measured. Notch filters, low pass filters, and high pass filters were used to achieve sufficient measurement sensitivity. Initially, peak measurements were performed across the spectrum. If a peak measurement complies with a peak, average, or a quasi-peak limit, the peak value is sufficient to demonstrate compliance.

The detector was set to peak, the sweep time was set to auto, and the trace was set to max-hold until the trace stabilized. If the peak value exceeded the quasi-peak or the average limit, another measurement would then need to be performed. For this test, this was not necessary.

The conducted output power was measured and depending on frequency range of the measured value, appropriate maximum ground reflection factor was also added. The maximum ground reflection factor is: 6 dB at or below 30 MHz, 4.7 dB above 30 MHz and below 1000 MHz, inclusive, and 0 dB when above 1000 MHz. The adjusted output power then had the maximum antenna gain (in dBi) added to calculate the EIRP. From the EIRP, the electric field was calculated by the following formula:

$E = EIRP – 20\log(d) + 104.8$

Where E is the electric field strength in dBuV/m, EIRP is the equivalent isotropically radiated power in dBm, and d is the specified measurement distance in m.

Screen capture(s) Offset = “Internal” cable loss factor not shown on screen capture + Ref Lvl Offset showing expected attenuator value and any other losses

SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

SPURIOUS RADIA element

XMit 2022.02.07.0

EUT:	SEL-3031R			**Work Order:**	SCHW0252
Serial Number:	See configuration			**Date:**	7-Dec-22
Customer:	Schweitzer Engineering Laboratories, Inc.			**Temperature:**	21.8 °C
Attendees:	Erik Floden			**Humidity:**	36.3% RH
Project:	None			**Barometric Pres.:**	1024 mbar
Tested by:	Jeff Alcoke	**Power:**	15 VDC via 110VAC/60Hz	**Job Site:**	EV01

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Corrected Peak OP value includes appropriate ground reflection factor. The second harmonic of this radio does not fall into a restricted band. QP limits apply for measurements below 1 GHz, while both peak and average limits apply above 1 GHz.

DEVIATIONS FROM TEST STANDARD

None

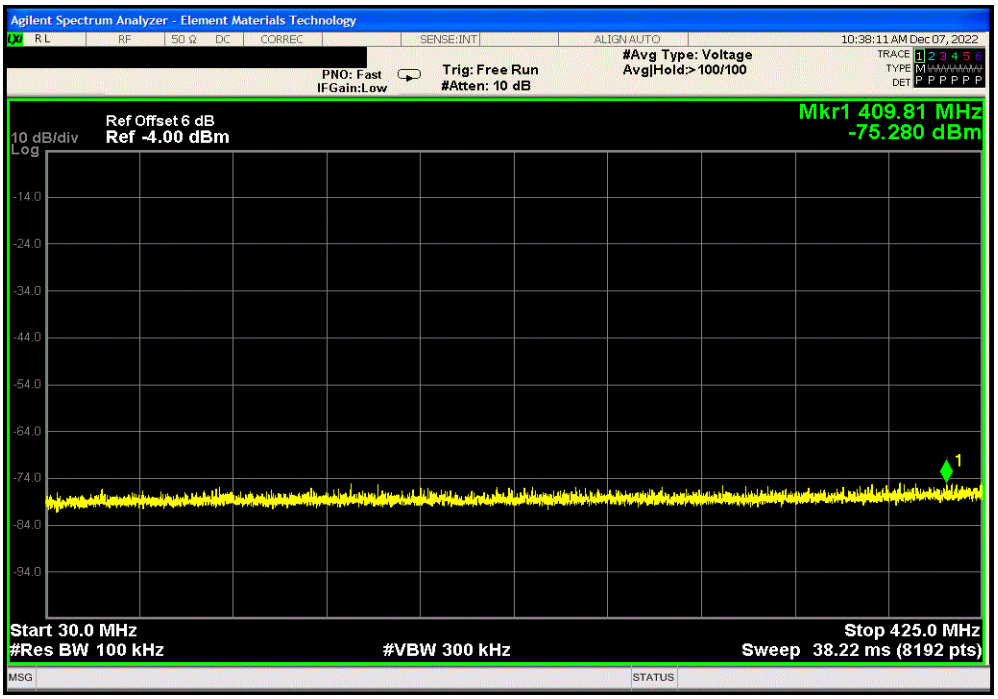
Configuration #	1	*Signature*

	Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
Single Channel - High Power Mode								
Low Channel, 902.6 MHz								
30 - 425 MHz	409.8	-75.28	-70.58	9.15	33.8	N/A	46	Pass
425 - 1000 MHz	601.6	-66.90	-62.20	9.15	42.2	N/A	46	Pass
425 - 1000 MHz	966.6	-61.30	-56.60	9.15	47.8	N/A	54	Pass
1000 - 1200 MHz	1004	-57.90	-57.90	9.15	46.5	74	54	Pass
1200 - 5500 MHz	4513	-60.01	-60.01	9.15	44.4	74	54	Pass
5500 - 10000 MHz	9026	-59.44	-59.44	9.15	45.0	74	54	Pass
Mid Channel, 915.2 MHz								
30 - 425 MHz	408	-75.20	-70.50	9.15	33.9	N/A	46	Pass
425 - 1000 MHz	601.6	-66.10	-61.40	9.15	43.0	N/A	46	Pass
425 - 1000 MHz	979.2	-60.20	-55.50	9.15	48.9	N/A	54	Pass
1000 - 1200 MHz	1005	-53.50	-53.50	9.15	50.9	74	54	Pass
1200 - 5500 MHz	4576	-58.00	-58.00	9.15	46.4	74	54	Pass
5500 - 10000 MHz	9152	-60.20	-60.20	9.15	44.2	74	54	Pass
High Channel, 927.5 MHz								
30 - 425 MHz	407.1	-75.40	-70.70	9.15	33.7	N/A	46	Pass
425 - 1000 MHz	601.6	-68.06	-63.36	9.15	41.0	N/A	46	Pass
425 - 1000 MHz	965.1	-60.31	-55.61	9.15	48.8	N/A	54	Pass
1000 - 1200 MHz	1029	-54.80	-54.80	9.15	49.6	74	54	Pass
1200 - 5500 MHz	2782.5	-58.05	-58.05	9.15	46.4	74	54	Pass
5500 - 10000 MHz	8347.5	-59.53	-59.53	9.15	44.9	74	54	Pass
Single Channel - Low Power Mode								
Low Channel, 902.6 MHz								
30 - 425 MHz	402.19	-75.10	-70.40	14.15	39.0	N/A	46	Pass
425 - 1000 MHz	601.61	-71.63	-66.93	14.15	42.5	N/A	46	Pass
425 - 1000 MHz	977.83	-71.98	-67.28	14.15	42.1	N/A	54	Pass
1000 - 1200 MHz	1000.9	-63.20	-63.20	14.15	46.2	74	54	Pass
1200 - 5500 MHz	4513	-59.46	-59.50	14.15	49.9	74	54	Pass
5500 - 10000 MHz	9025.6	-58.29	-58.29	14.15	51.1	74	54	Pass
Mid Channel, 915.2 MHz								
30 - 425 MHz	326.19	-74.61	-69.91	14.15	39.5	N/A	46	Pass
425 - 1000 MHz	601.61	-70.98	-66.28	14.15	43.1	N/A	46	Pass
425 - 1000 MHz	966.53	-70.13	-65.43	14.15	44.0	N/A	54	Pass
1000 - 1200 MHz	1195.6	-63.76	-63.76	14.15	45.6	74	54	Pass
1200 - 5500 MHz	4598.6	-58.12	-58.12	14.15	51.3	74	54	Pass
5500 - 10000 MHz	9152	-58.91	-58.91	14.15	50.5	74	54	Pass
High Channel, 927.5 MHz								
30 - 425 MHz	400.24	-76.05	-71.35	14.15	38.1	N/A	46	Pass
425 - 1000 MHz	601.61	-71.80	-67.10	14.15	42.3	N/A	46	Pass
425 - 1000 MHz	965.98	-70.84	-66.14	14.15	43.3	N/A	54	Pass
1000 - 1200 MHz	1009	-63.10	-63.10	14.15	46.3	74	54	Pass
1200 - 5500 MHz	3660.8	-59.59	-59.59	14.15	49.8	74	54	Pass
5500 - 10000 MHz	9275	-60.12	-60.12	14.15	49.3	74	54	Pass

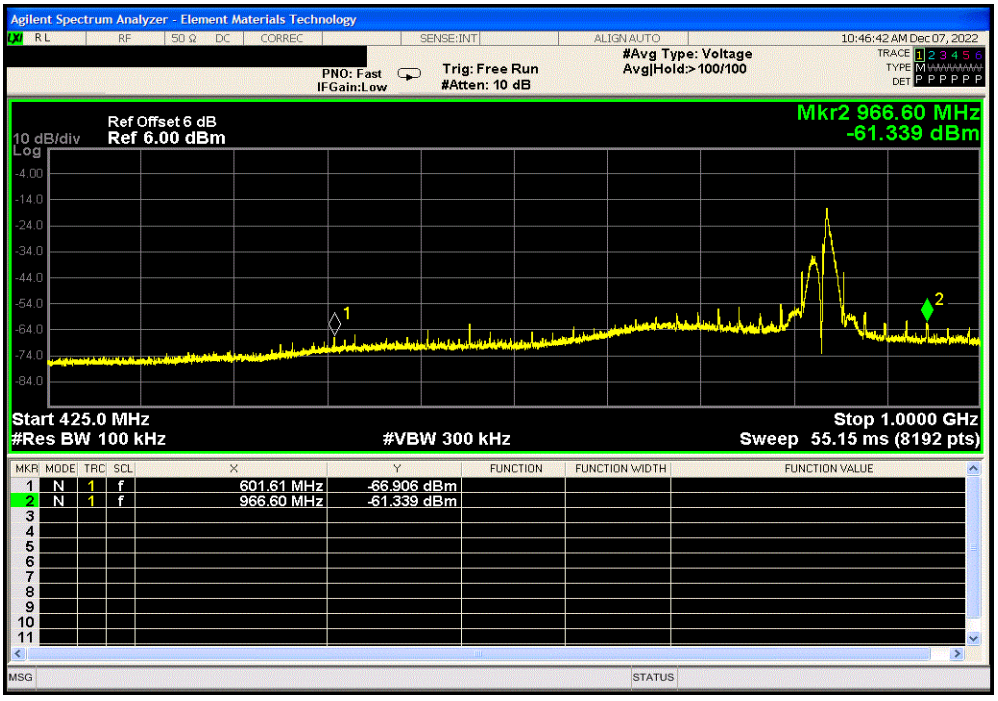
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - High Power Mode, Low Channel, 902.6 MHz, 30 - 425 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
409.8	-75.28	-70.58	9.15	33.8	N/A	46	Pass



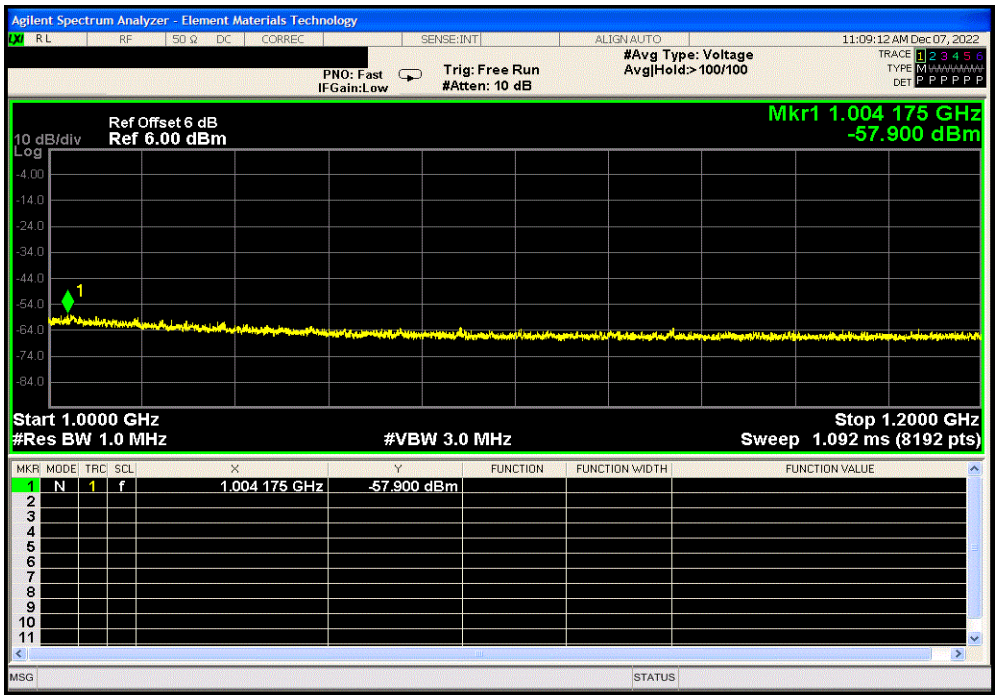
Single Channel - High Power Mode, Low Channel, 902.6 MHz, 425 - 1000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
601.6	-66.9	-62.2	9.15	42.2	N/A	46	Pass
966.6	-61.3	-56.6	9.15	47.8	N/A	54	Pass



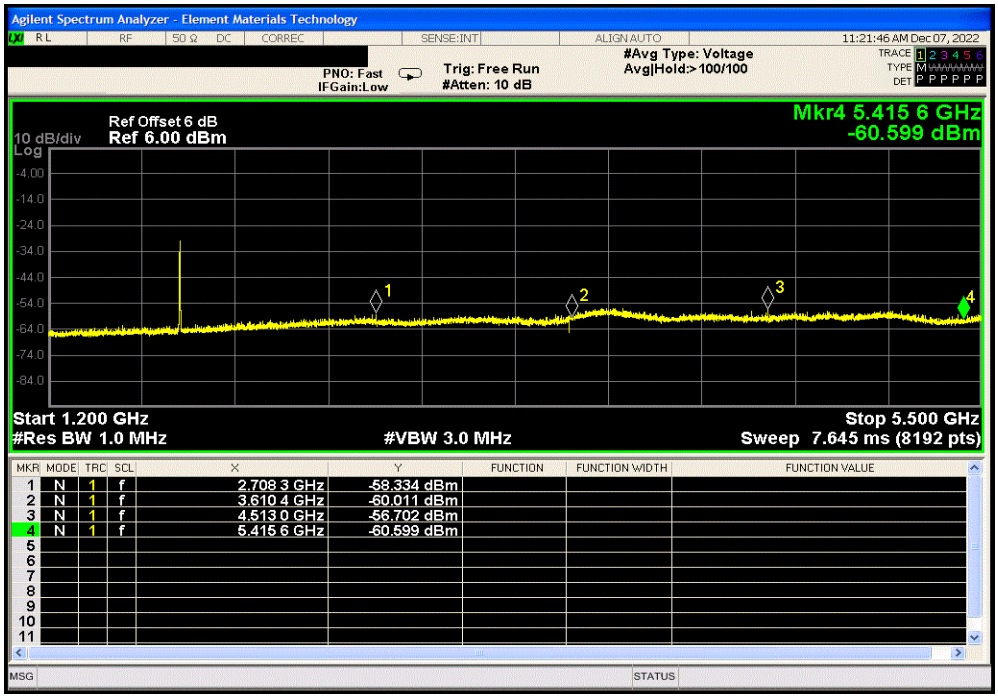
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - High Power Mode, Low Channel, 902.6 MHz, 1000 - 1200 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
1004	-57.9	-57.9	9.15	46.5	74	54	Pass



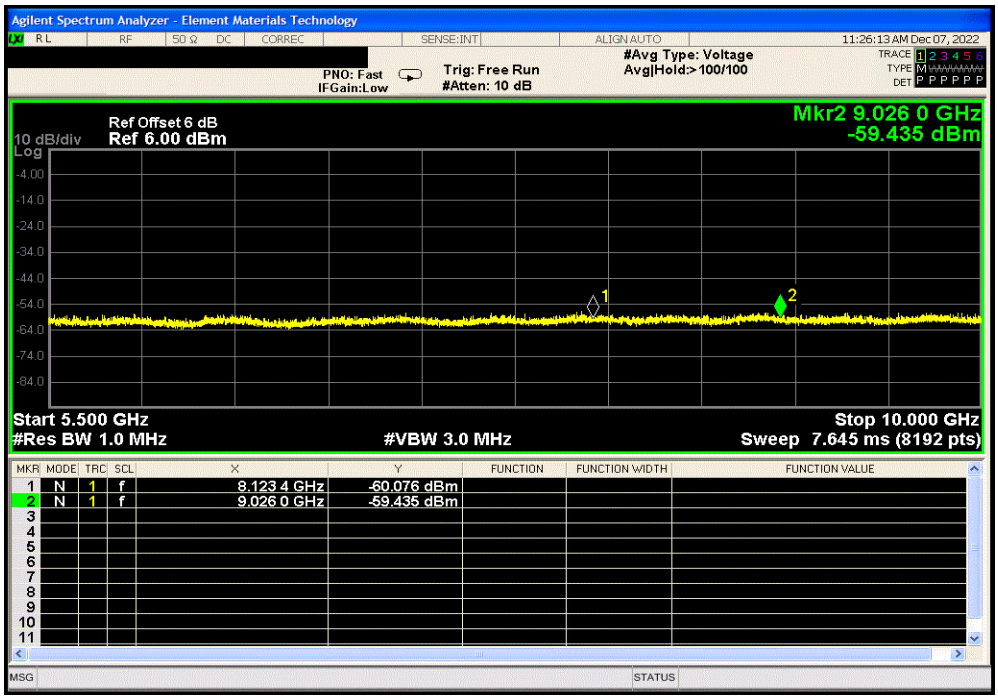
Single Channel - High Power Mode, Low Channel, 902.6 MHz, 1200 - 5500 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
4513	-60.01	-60.01	9.15	44.4	74	54	Pass



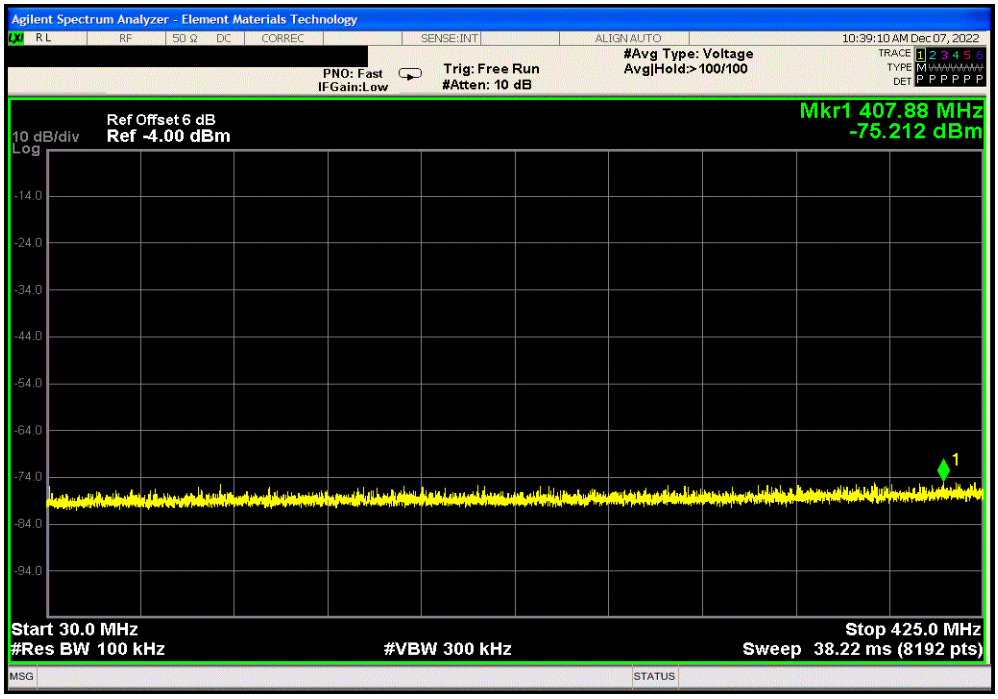
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - High Power Mode, Low Channel, 902.6 MHz, 5500 - 10000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
9026	-59.44	-59.44	9.15	45.0	74	54	Pass



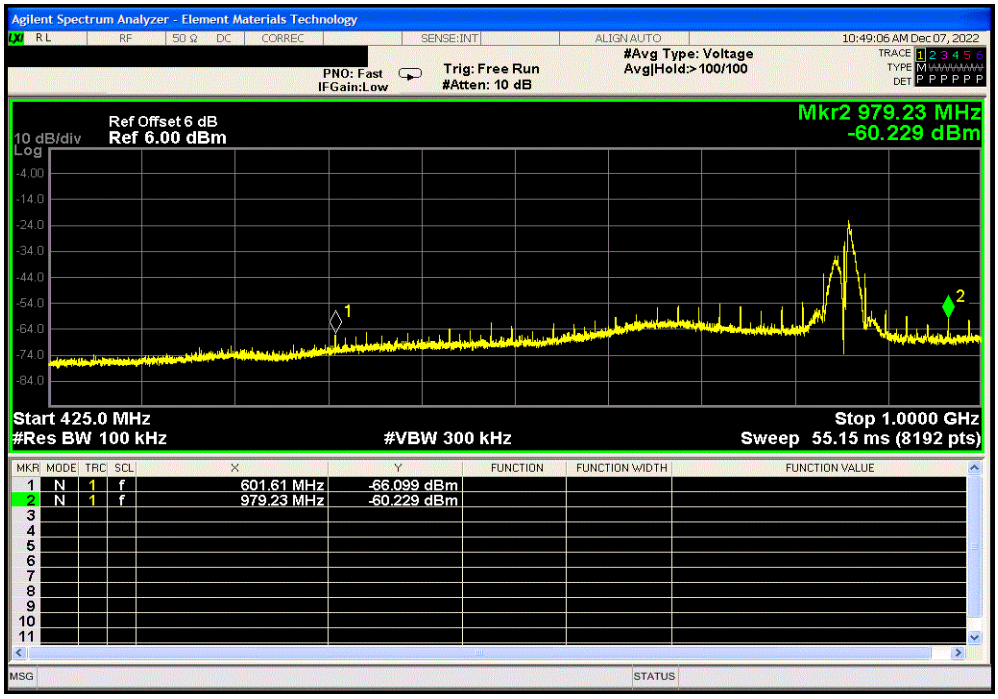
Single Channel - High Power Mode, Mid Channel, 915.2 MHz, 30 - 425 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
408	-75.2	-70.5	9.15	33.9	N/A	46	Pass



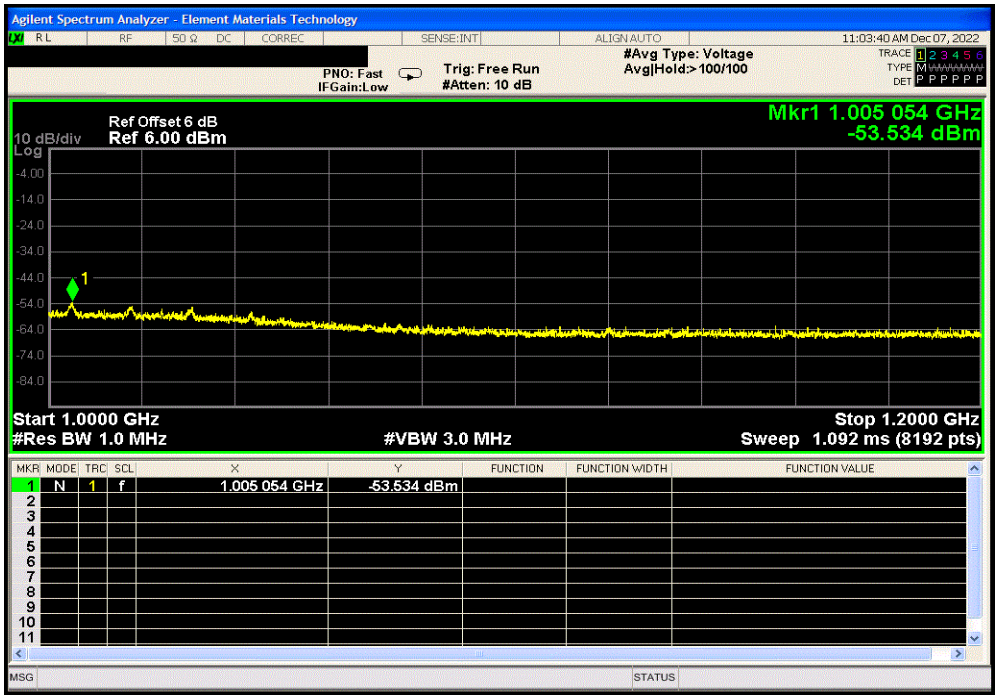
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - High Power Mode, Mid Channel, 915.2 MHz, 425 - 1000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
601.6	-66.1	-61.4	9.15	43.0	N/A	46	Pass
979.2	-60.2	-55.5	9.15	48.9	N/A	54	Pass



Single Channel - High Power Mode, Mid Channel, 915.2 MHz, 1000 - 1200 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
1005	-53.5	-53.5	9.15	50.9	74	54	Pass

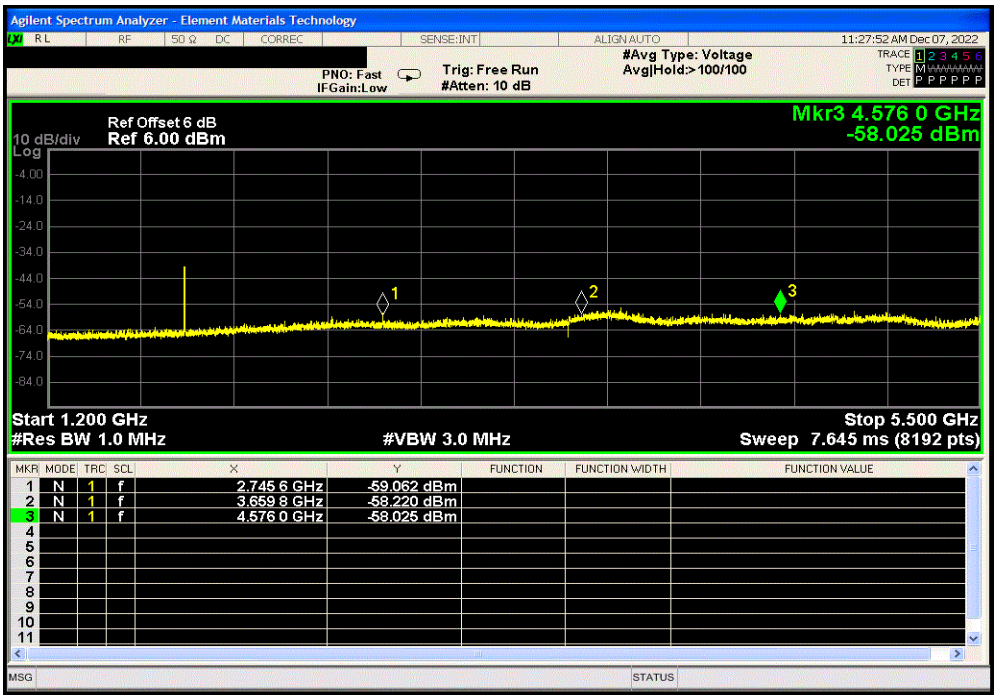


SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

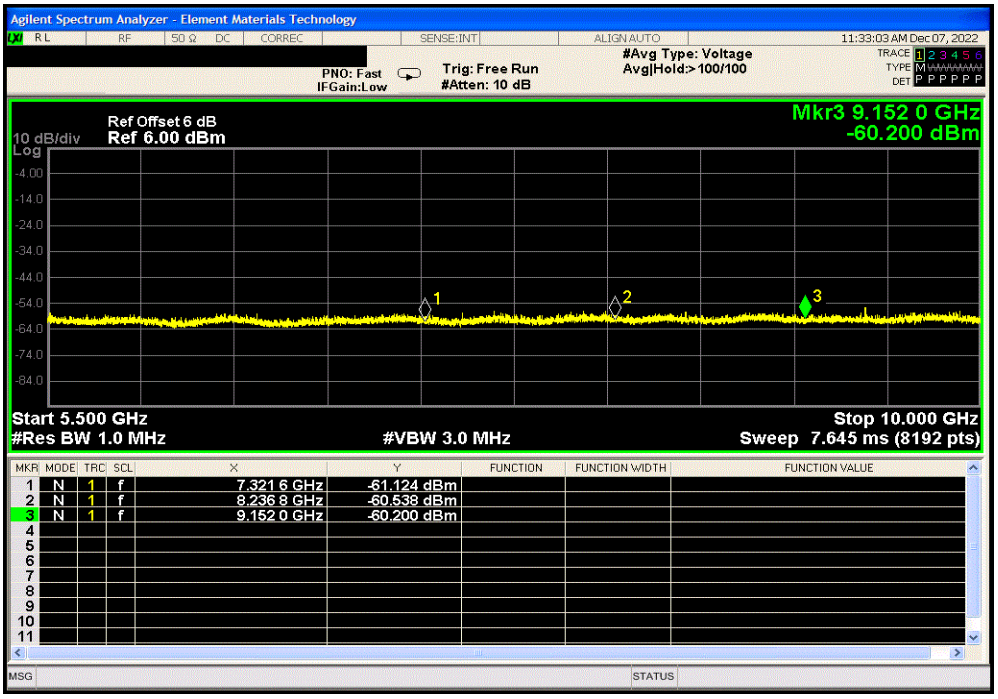
element

XMit 2022.02.07.0

Single Channel - High Power Mode, Mid Channel, 915.2 MHz, 1200 - 5500 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
4576	-58	-58	9.15	46.4	74	54	Pass



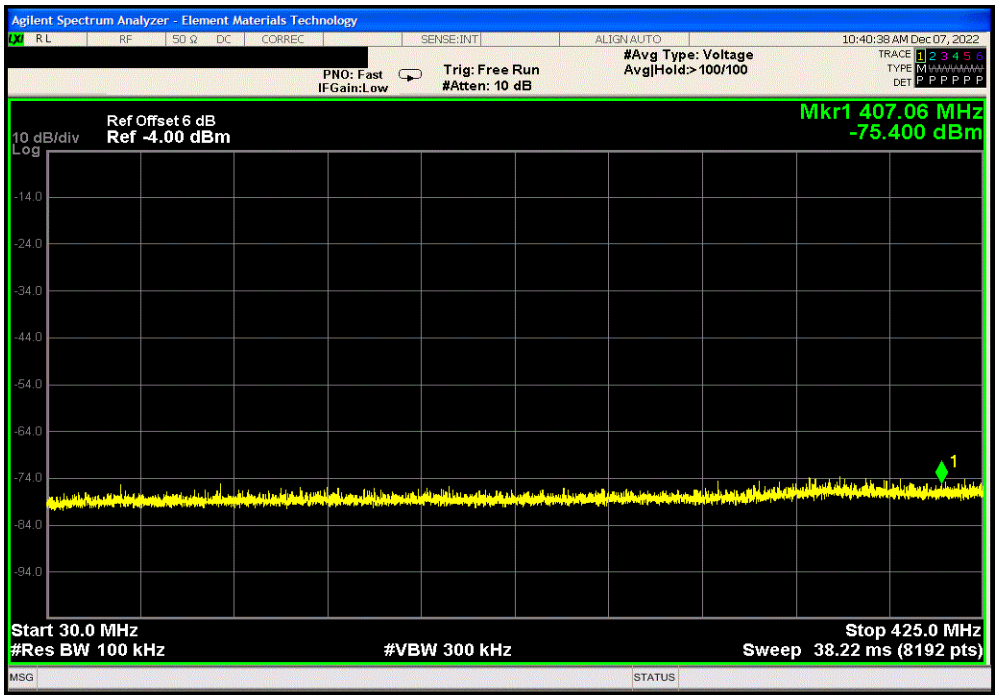
Single Channel - High Power Mode, Mid Channel, 915.2 MHz, 5500 - 10000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
9152	-60.2	-60.2	9.15	44.2	74	54	Pass



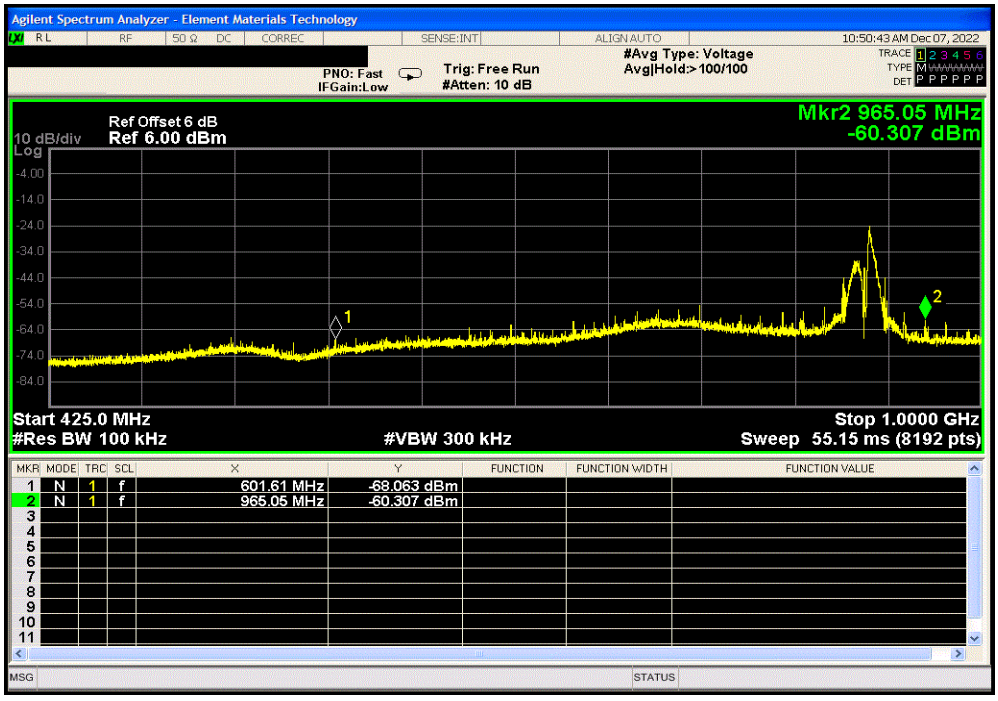
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - High Power Mode, High Channel, 927.5 MHz, 30 - 425 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
407.1	-75.4	-70.7	9.15	33.7	N/A	46	Pass



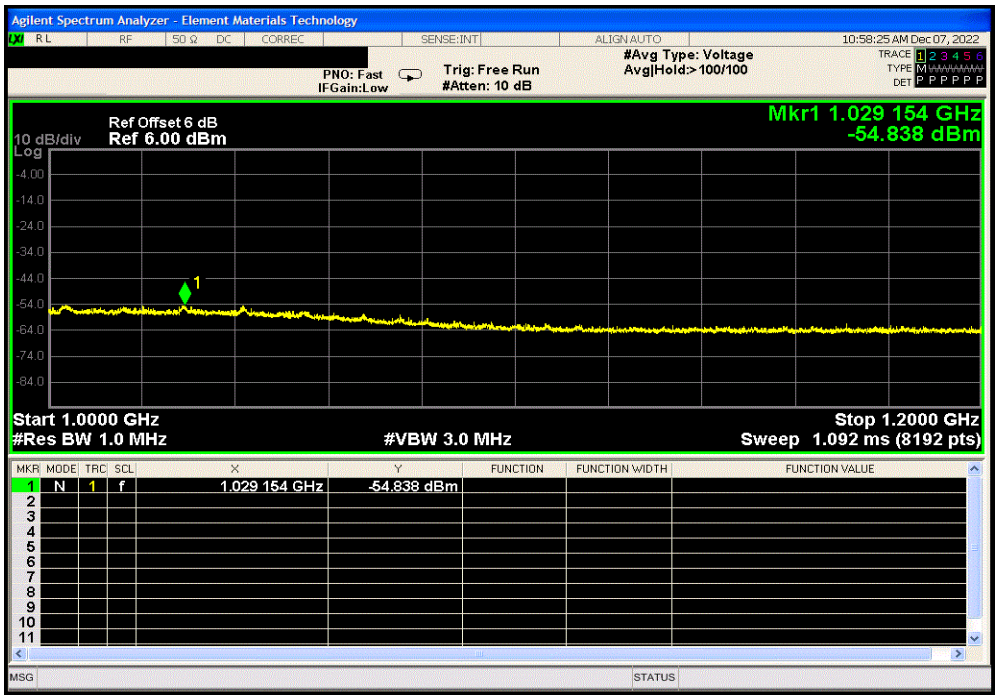
Single Channel - High Power Mode, High Channel, 927.5 MHz, 425 - 1000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
601.6	-68.06	-63.36	9.15	41.0	N/A	46	Pass
965.1	-60.31	-55.61	9.15	48.8	N/A	54	Pass



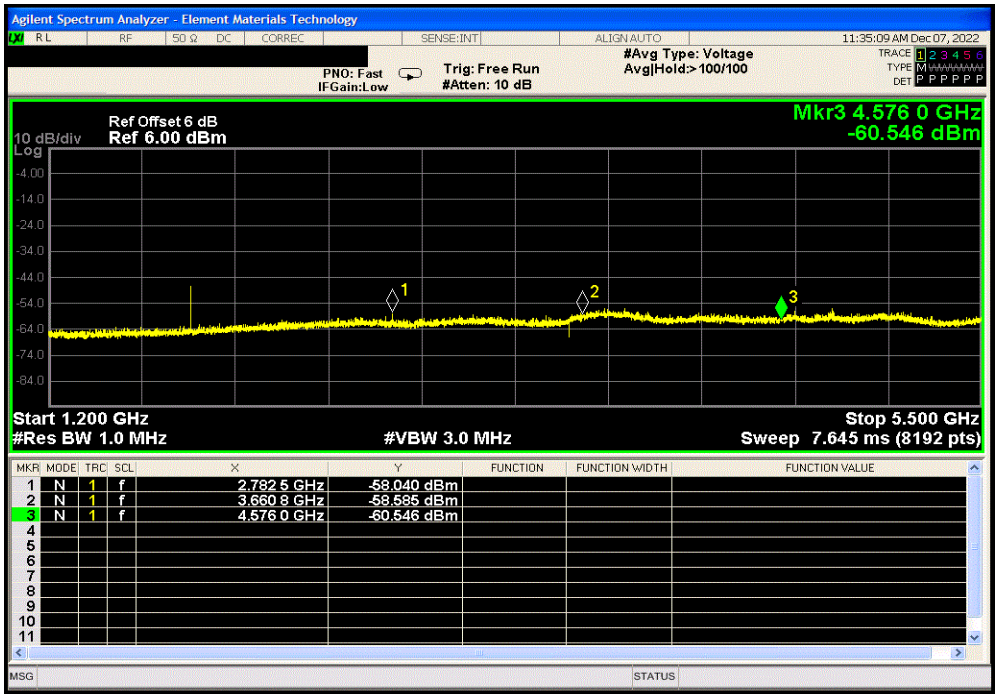
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

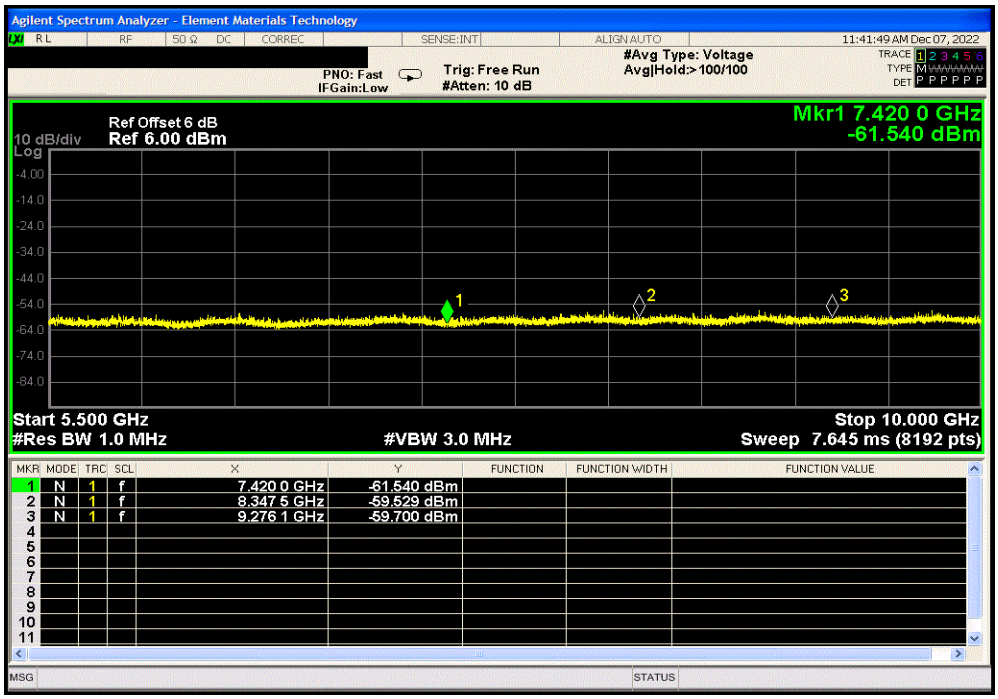
Single Channel - High Power Mode, High Channel, 927.5 MHz, 1000 - 1200 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
1029	-54.8	-54.8	9.15	49.6	74	54	Pass



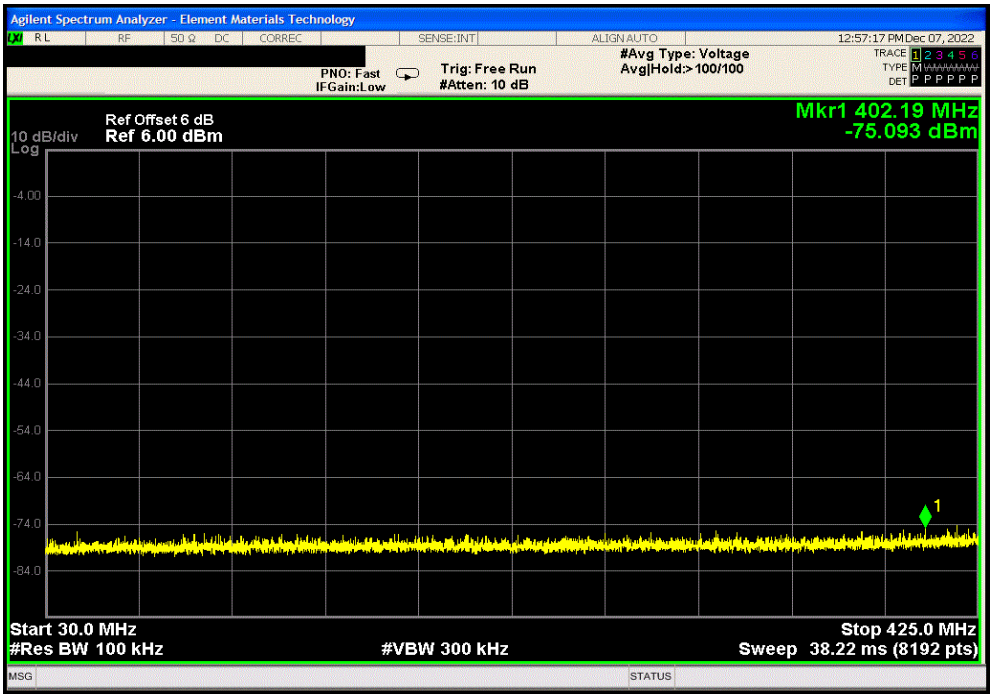
Single Channel - High Power Mode, High Channel, 927.5 MHz, 1200 - 5500 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
2782.5	-58.05	-58.05	9.15	46.4	74	54	Pass



Single Channel - High Power Mode, High Channel, 927.5 MHz, 5500 - 10000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
8347.5	-59.53	-59.53	9.15	44.9	74	54	Pass



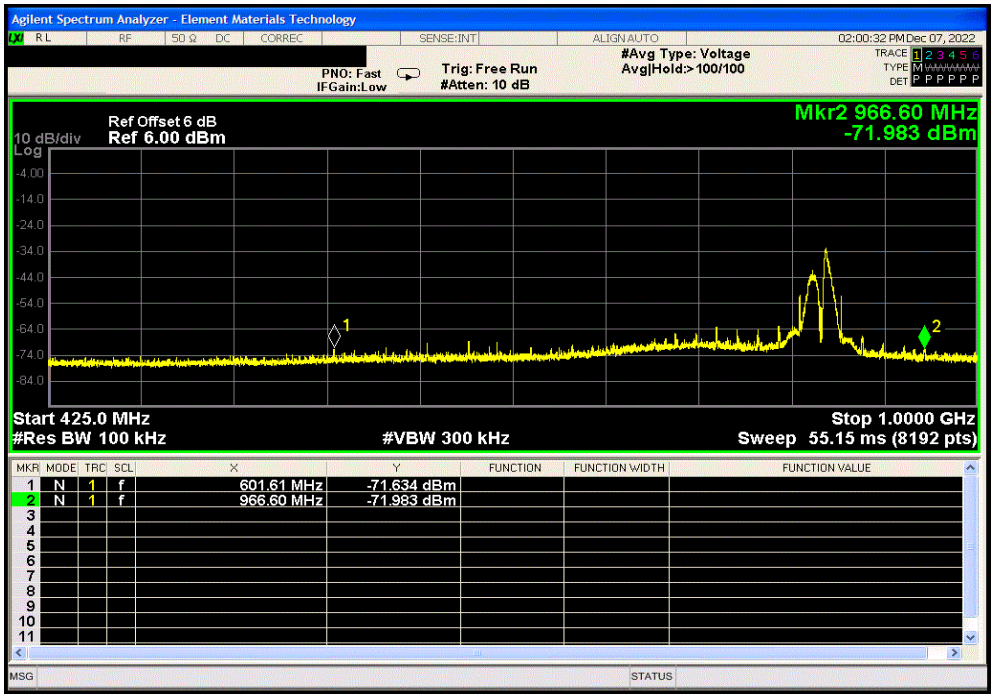
Single Channel - Low Power Mode, Low Channel, 902.6 MHz, 30 - 425 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
402.19	-75.1	-70.4	14.15	39.0	N/A	46	Pass



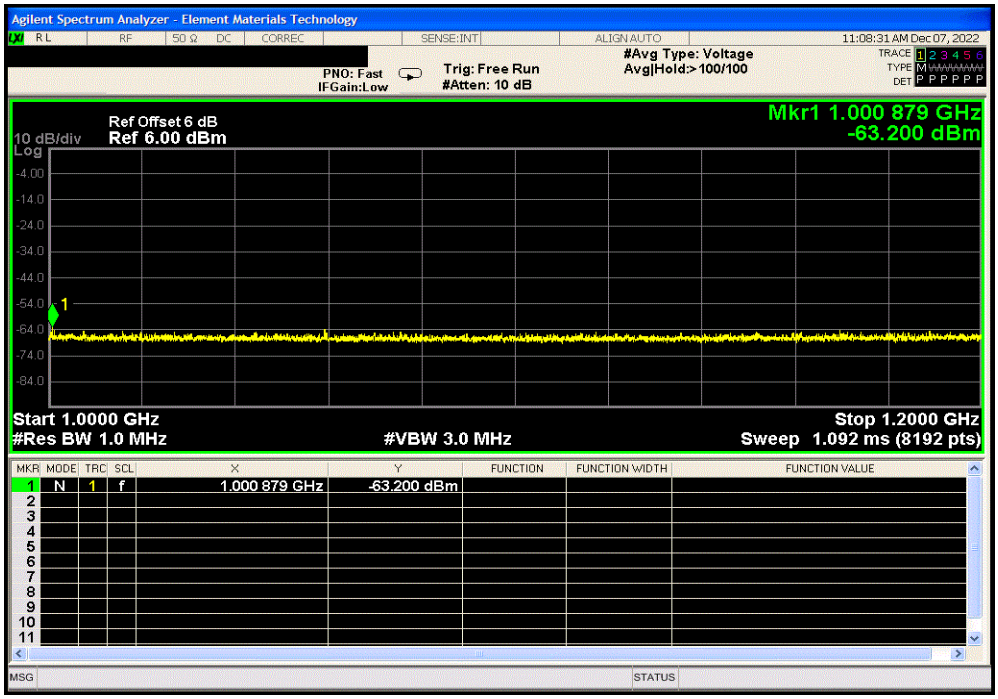
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - Low Power Mode, Low Channel, 902.6 MHz, 425 - 1000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
601.61	-71.63	-66.93	14.15	42.48	N/A	46	Pass
977.83	-71.98	-67.28	14.15	42.1	N/A	54	Pass



Single Channel - Low Power Mode, Low Channel, 902.6 MHz, 1000 - 1200 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
1000.9	-63.2	-63.2	14.15	46.2	74	54	Pass

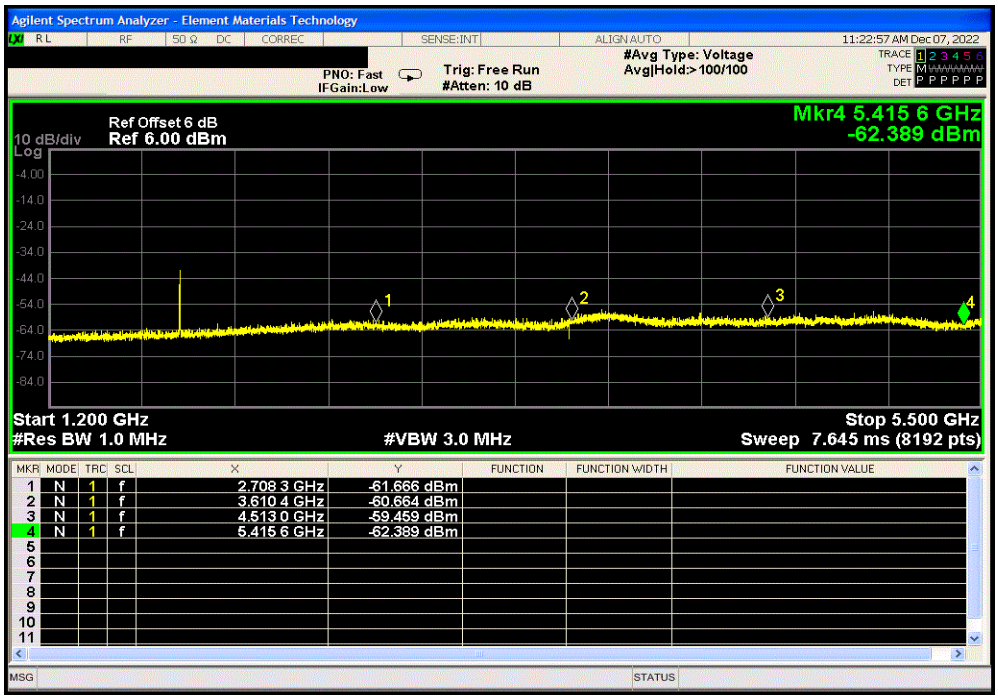


SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

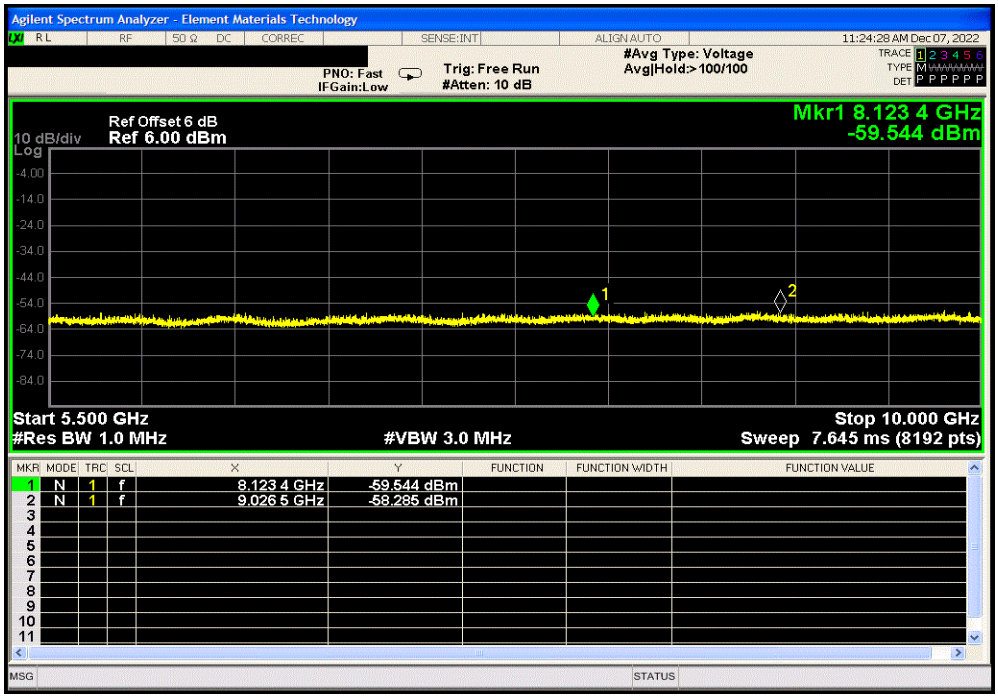
element

XMit 2022.02.07.0

Single Channel - Low Power Mode, Low Channel, 902.6 MHz, 1200 - 5500 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
4513	-59.46	-59.50	14.15	49.9	74	54	Pass



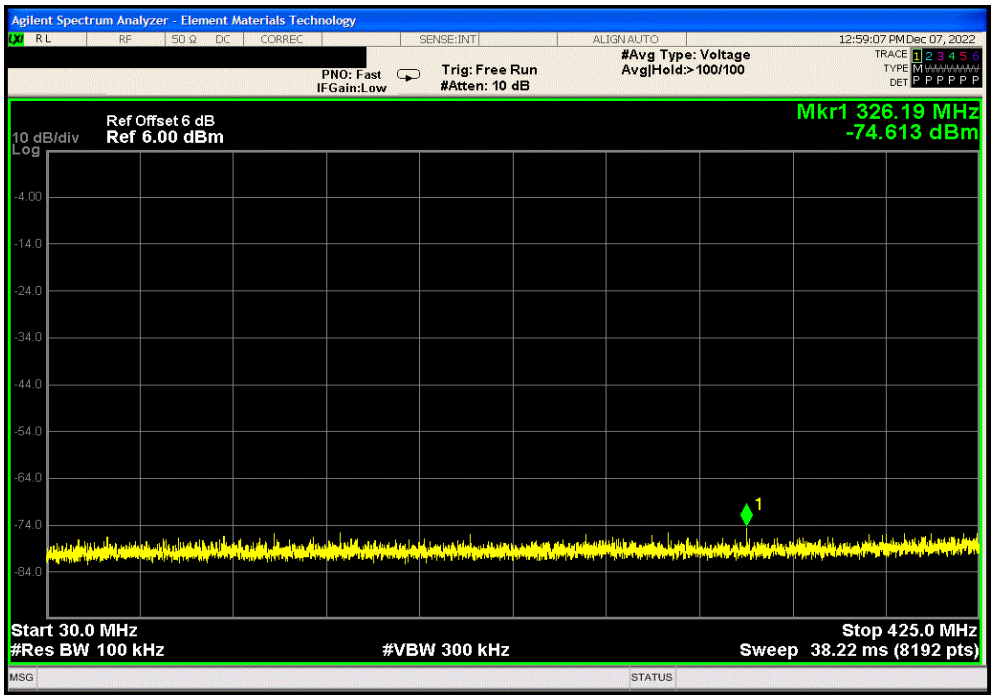
Single Channel - Low Power Mode, Low Channel, 902.6 MHz, 5500 - 10000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
9025.6	-58.29	-58.29	14.15	51.1	74	54	Pass



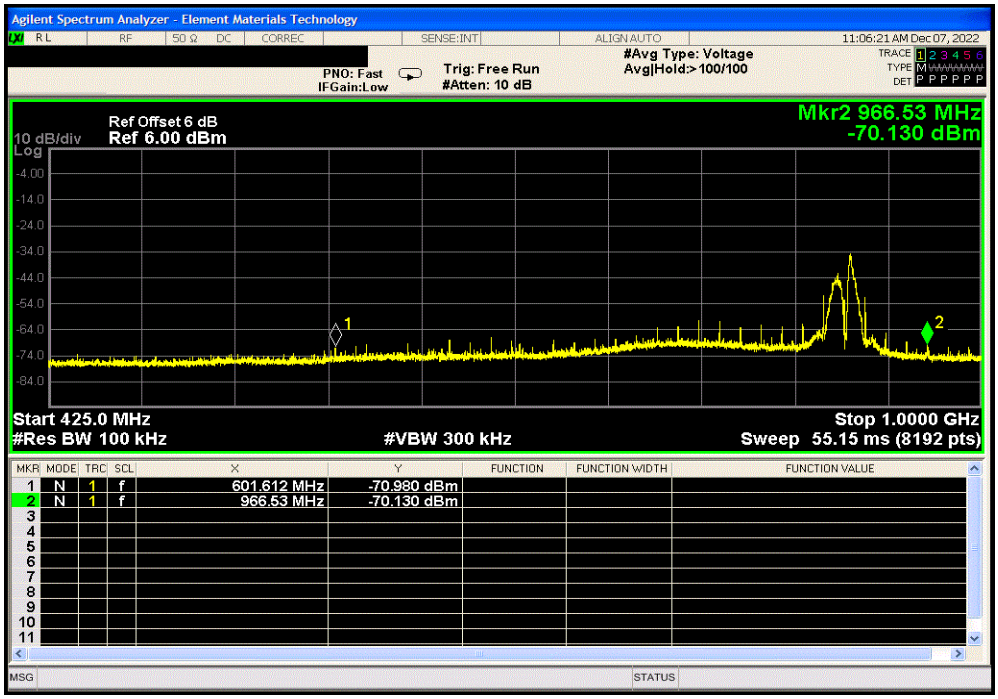
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - Low Power Mode, Mid Channel, 915.2 MHz, 30 - 425 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
326.19	-74.61	-69.91	14.15	39.5	N/A	46	Pass



Single Channel - Low Power Mode, Mid Channel, 915.2 MHz, 425 - 1000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
601.61	-70.98	-66.28	14.15	43.1	N/A	46	Pass
966.53	-70.13	-65.43	14.15	44.0	N/A	54	Pass

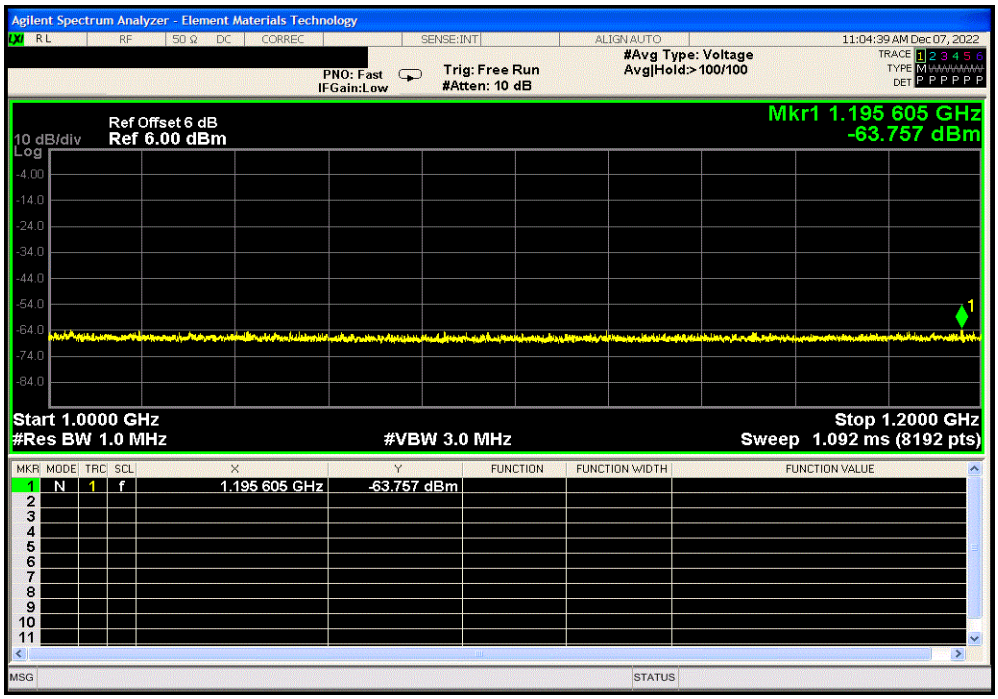


SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

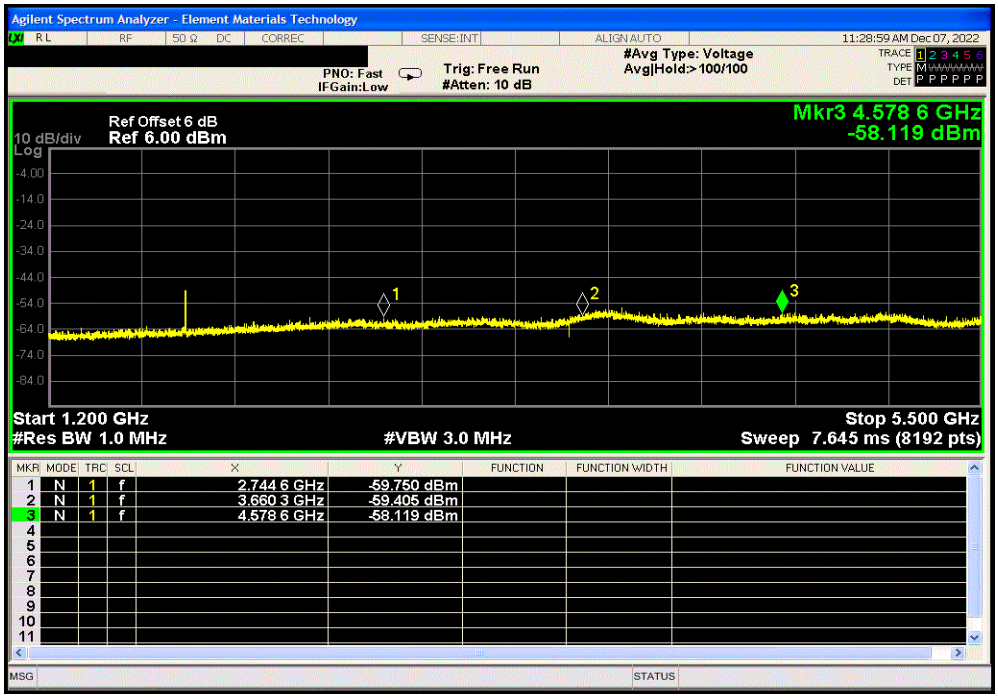
element

XMit 2022.02.07.0

Single Channel - Low Power Mode, Mid Channel, 915.2 MHz, 1000 - 1200 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
1195.6	-63.76	-63.76	14.15	45.6	74	54	Pass



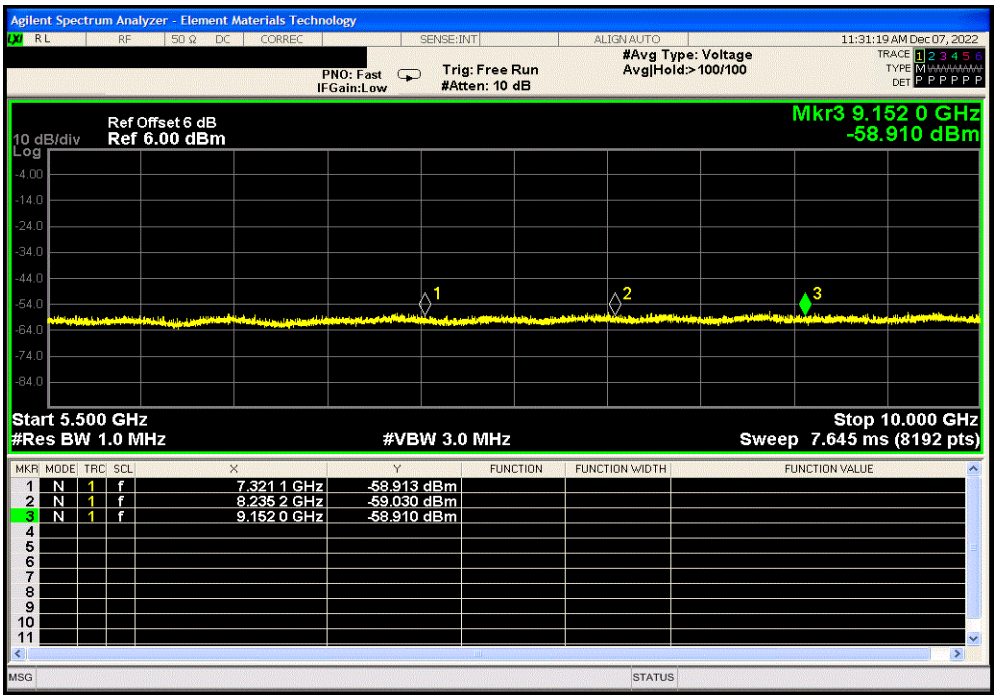
Single Channel - Low Power Mode, Mid Channel, 915.2 MHz, 1200 - 5500 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
4598.6	-58.12	-58.12	14.15	51.3	74	54	Pass



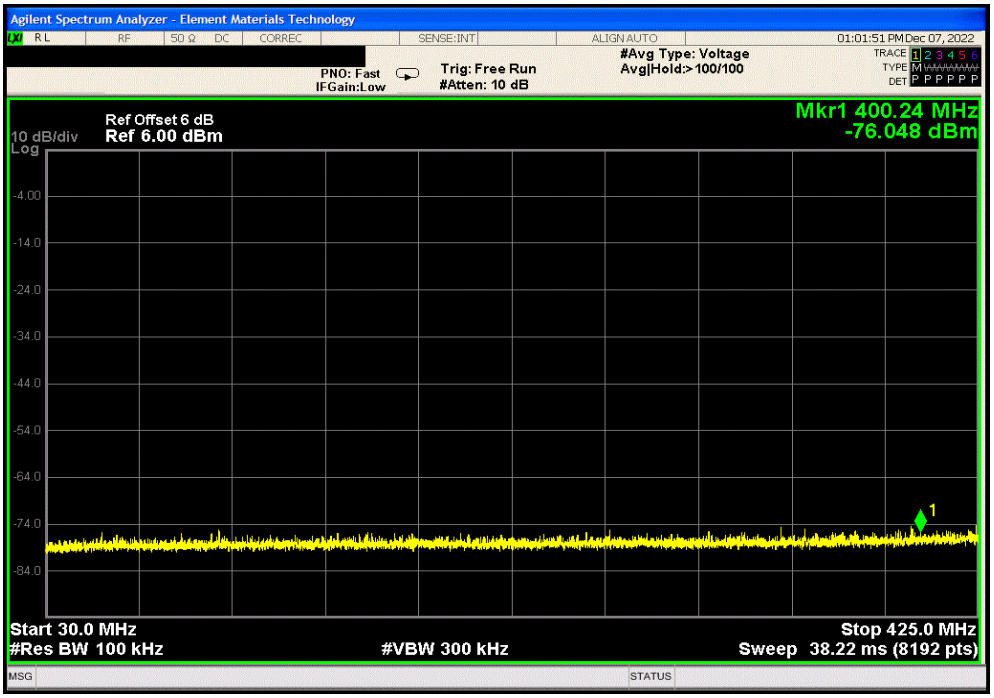
SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

XMit 2022.02.07.0

Single Channel - Low Power Mode, Mid Channel, 915.2 MHz, 5500 - 10000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
9152	-58.91	-58.91	14.15	50.5	74	54	Pass

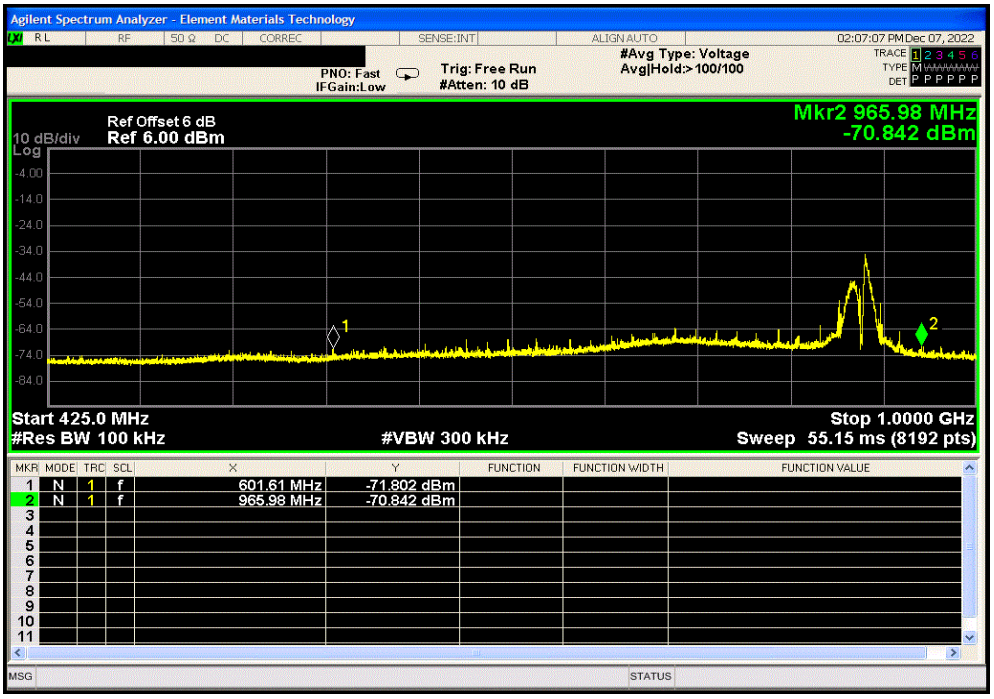


Single Channel - Low Power Mode, High Channel, 927.5 MHz, 30 - 425 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
400.24	-76.05	-71.35	14.15	38.1	N/A	46	Pass



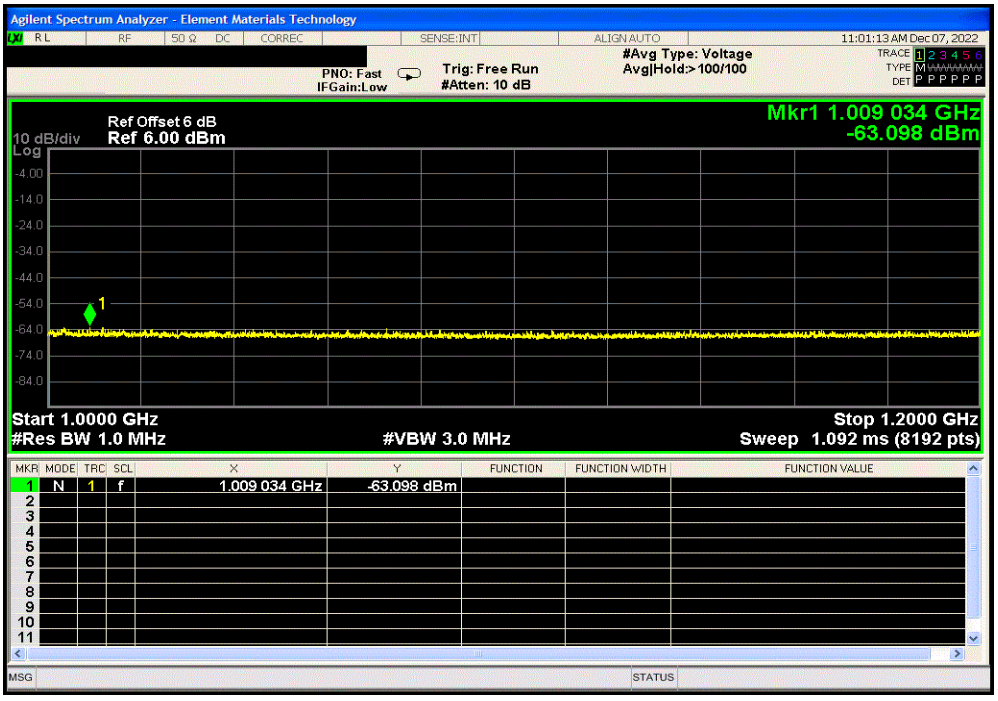
Single Channel - Low Power Mode, High Channel, 927.5 MHz, 425 - 1000 MHz

Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
601.61	-71.80	-67.10	14.15	42.3	N/A	46	Pass
965.98	-70.84	-66.14	14.15	43.3	N/A	54	Pass



Single Channel - Low Power Mode, High Channel, 927.5 MHz, 1000 - 1200 MHz

Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
1009	-63.1	-63.1	14.15	46.3	74	54	Pass

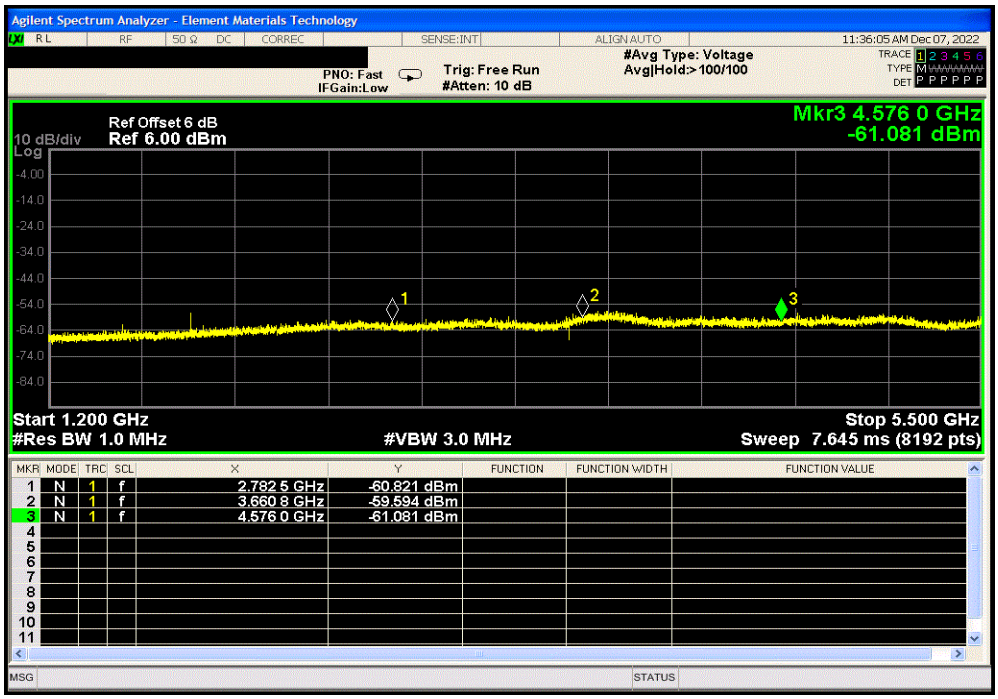


SPURIOUS EMISSIONS IN RESTRICTED BANDS (CONDUCTED)

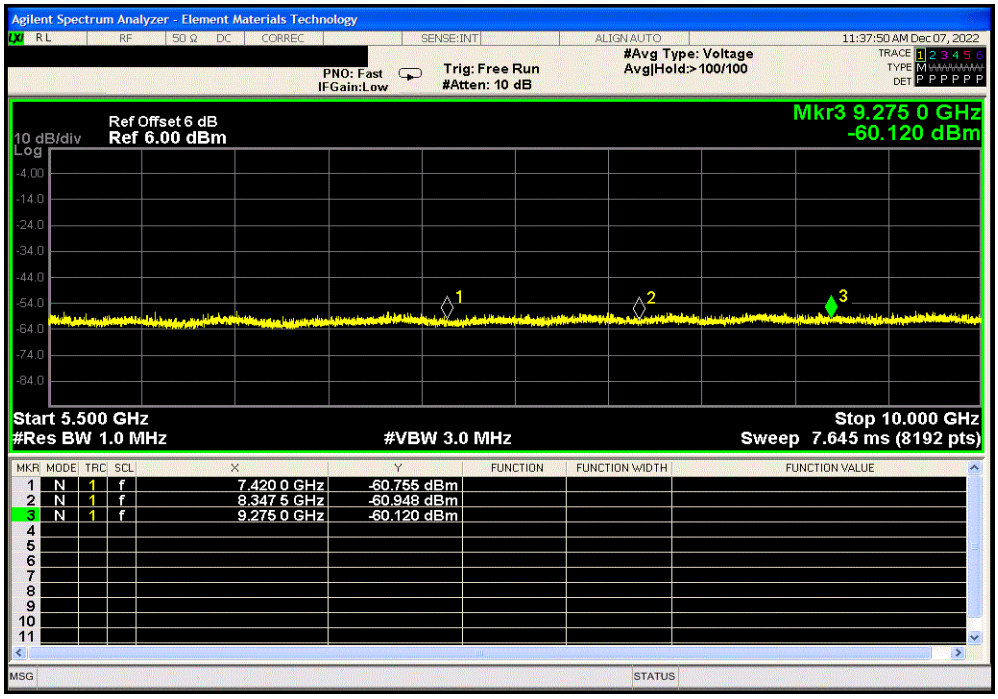
element

XMit 2022.02.07.0

Single Channel - Low Power Mode, High Channel, 927.5 MHz, 1200 - 5500 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
3660.8	-59.59	-59.59	14.15	49.8	74	54	Pass



Single Channel - Low Power Mode, High Channel, 927.5 MHz, 5500 - 10000 MHz							
Frequency (MHz)	Measured Peak OP (dBm)	Corrected Peak OP (dBm)	Antenna Gain (dBi)	Peak E-Field (dBµV/m)	Peak Limit (dBµV/m)	QP / Avg. Limit (dBµV/m)	Result
9275	-60.12	-60.12	14.15	49.3	74	54	Pass



DUTY CYCLE

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.1 °C**
Attendees:	**Erik Floden**			**Humidity:**	**34.9% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

DEVIATIONS FROM TEST STANDARD

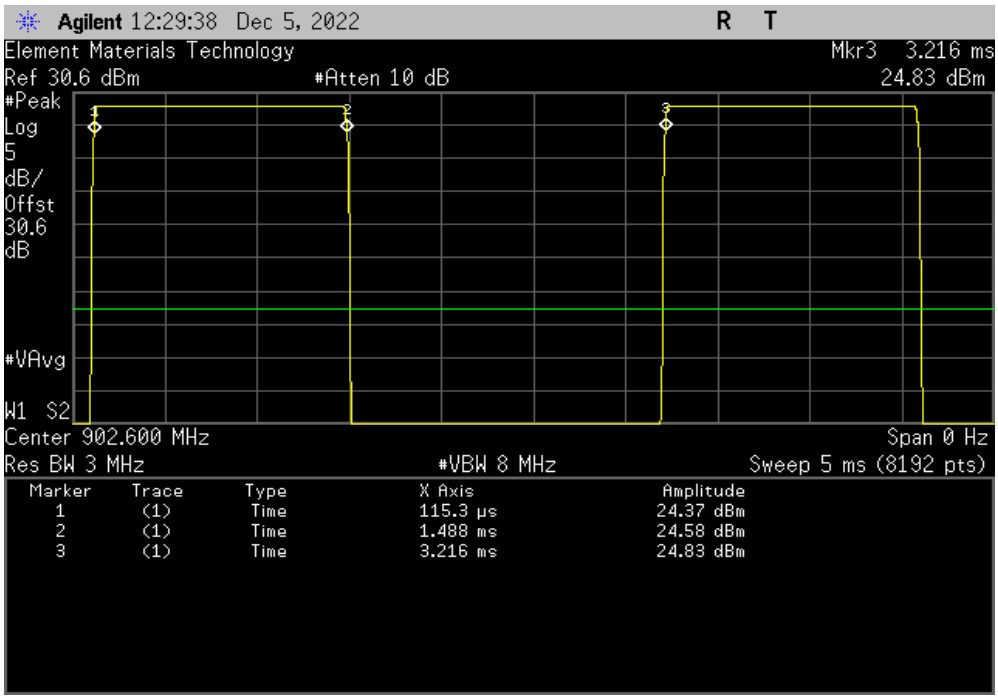
None

Configuration #	**1**	*Signature*

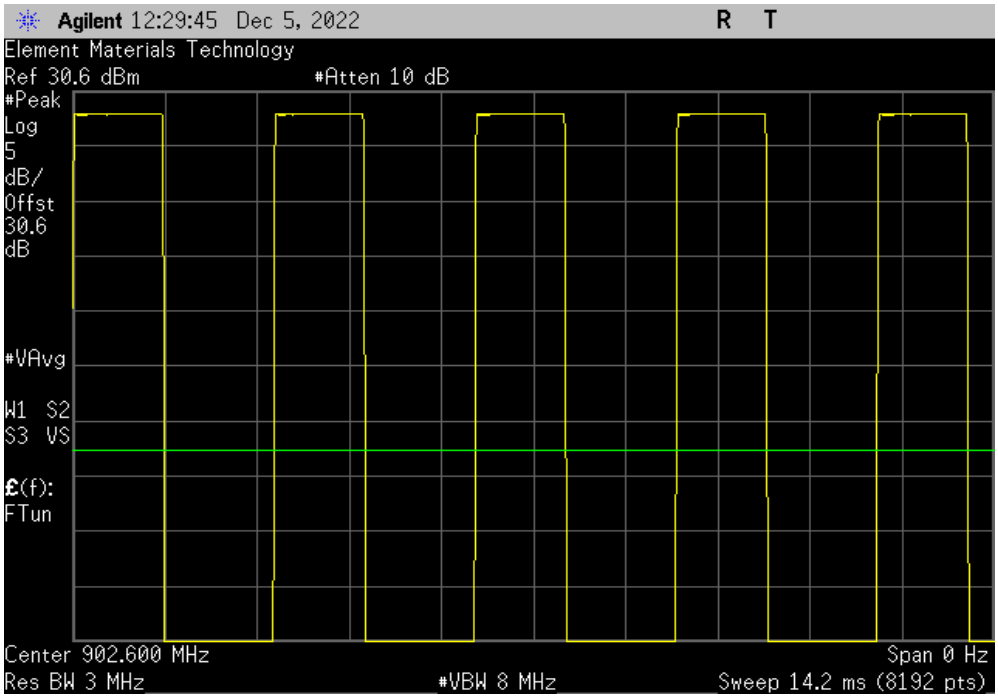
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
Single Channe - High Power Mode						
GFSK, 200 kbps						
Low Channel, 902.6 MHz	1.373 ms	3.101 ms	1	44.3	N/A	N/A
Low Channel, 902.6 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 915.2 MHz	1.374 ms	3.1 ms	1	44.3	N/A	N/A
Mid Channel, 915.2 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 927.5 MHz	1.376 ms	3.1 ms	1	44.4	N/A	N/A
High Channel, 927.5 MHz	N/A	N/A	5	N/A	N/A	N/A
Single Channe - Low Power Mode						
GFSK, 200 kbps						
Low Channel, 902.6 MHz	1.351 ms	3.1 ms	1	43.6	N/A	N/A
Low Channel, 902.6 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 915.2 MHz	1.35 ms	3.1 ms	1	43.6	N/A	N/A
Mid Channel, 915.2 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 927.5 MHz	1.351 ms	3.1 ms	1	43.6	N/A	N/A
High Channel, 927.5 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

Single Channe - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.373 ms	3.101 ms	1	44.3	N/A	N/A

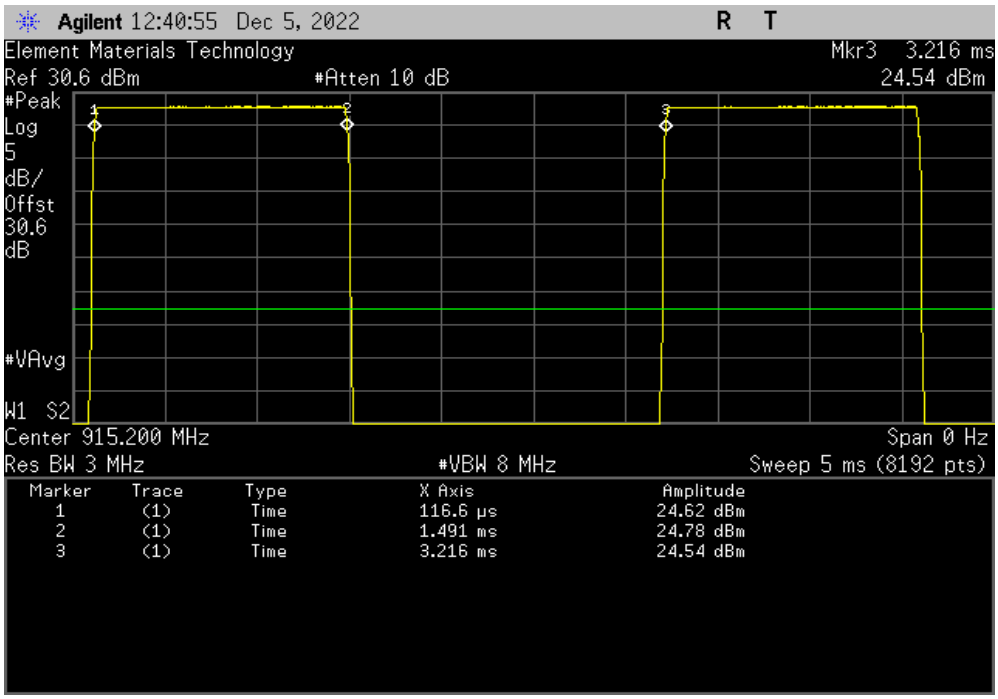


Single Channe - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

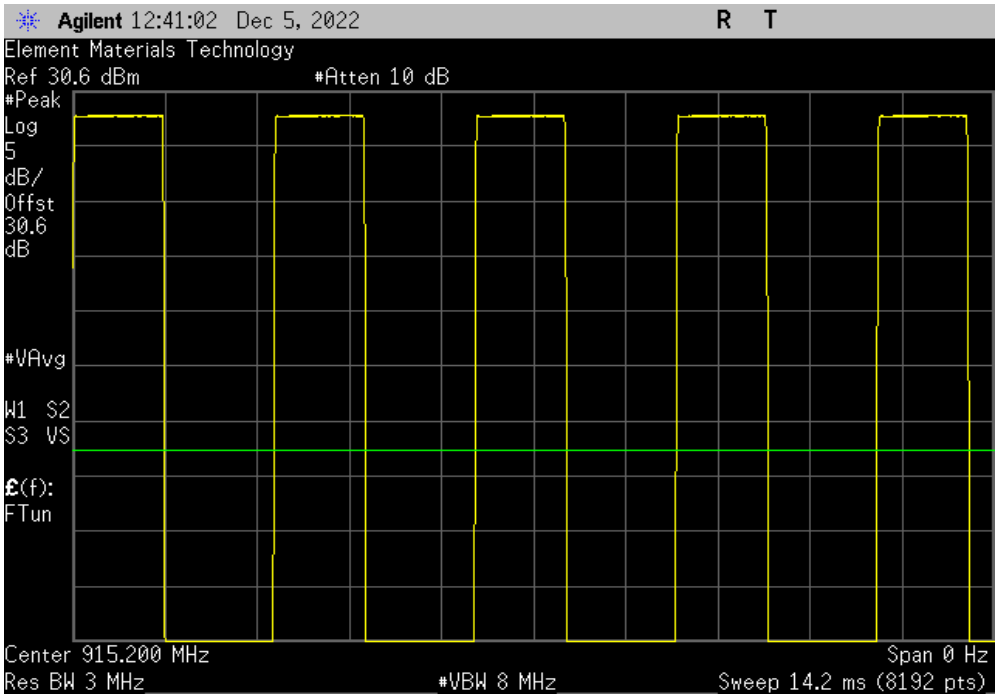


DUTY CYCLE

Single Channe - High Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.374 ms	3.1 ms	1	44.3	N/A	N/A

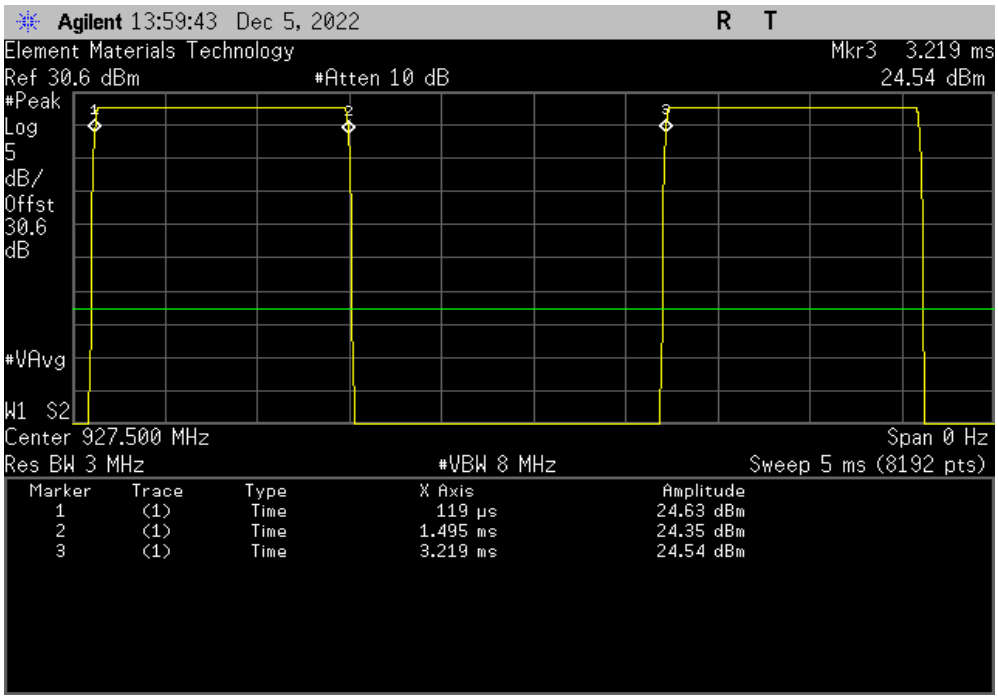


Single Channe - High Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

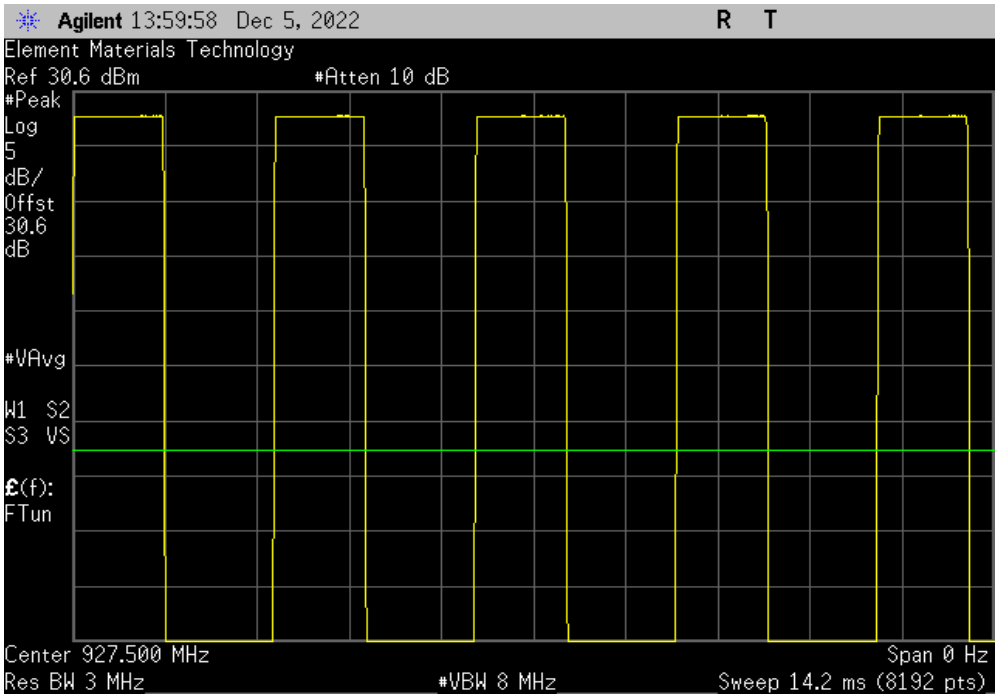


DUTY CYCLE

Single Channe - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.376 ms	3.1 ms	1	44.4	N/A	N/A

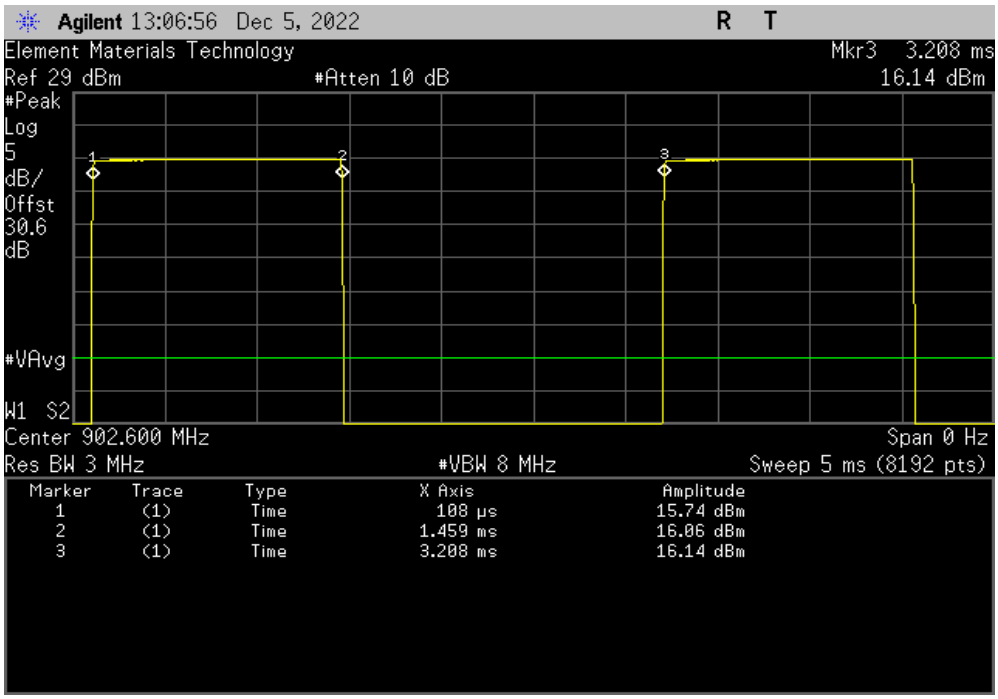


Single Channe - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

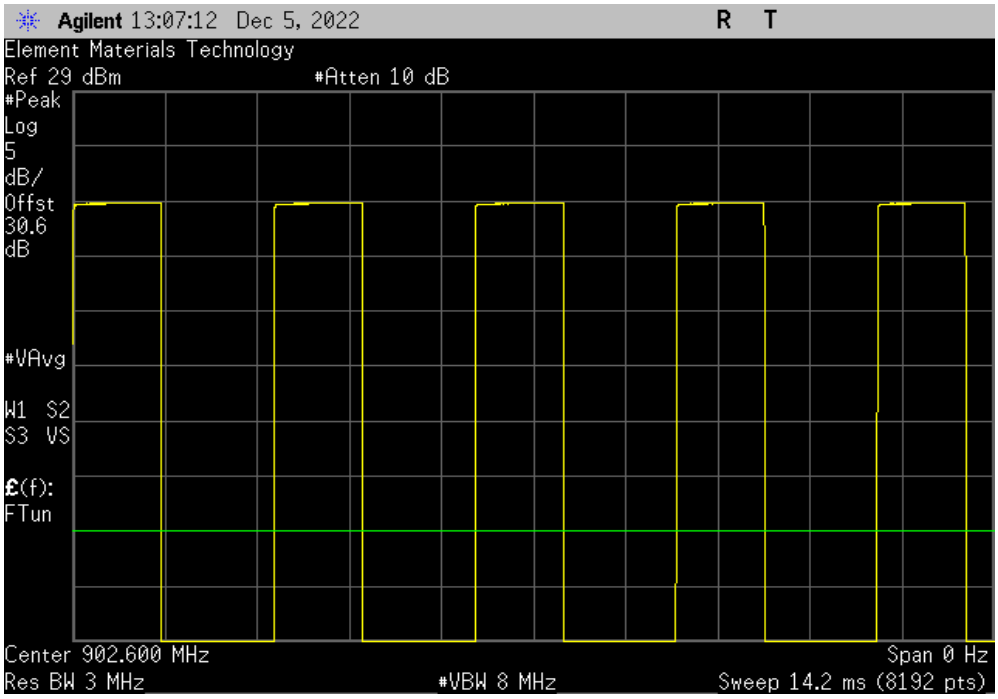


DUTY CYCLE

Single Channe - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.351 ms	3.1 ms	1	43.6	N/A	N/A

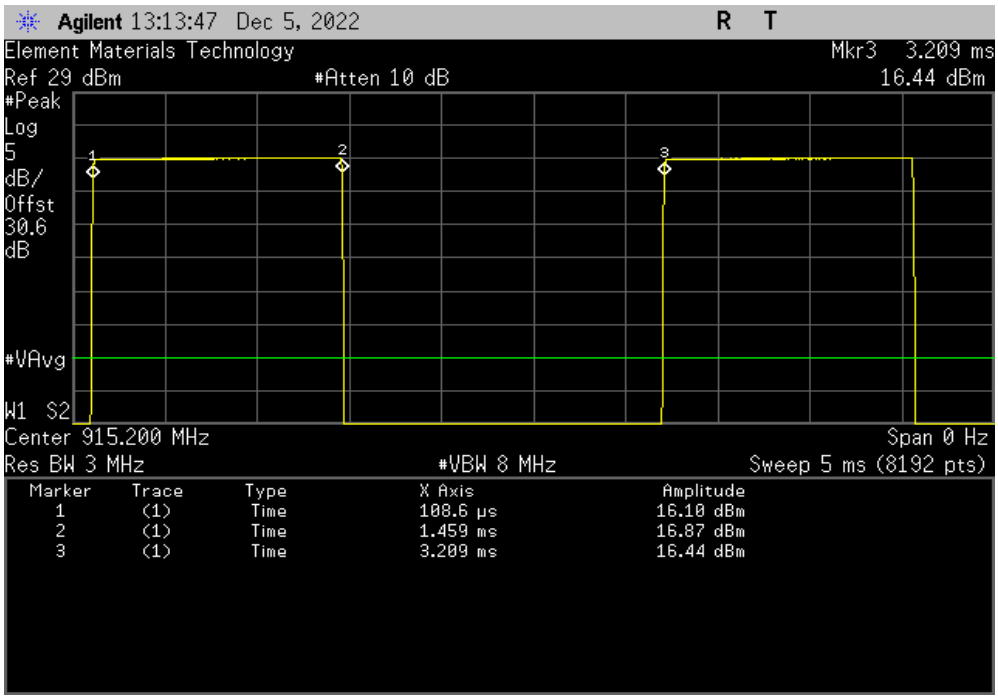


Single Channe - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

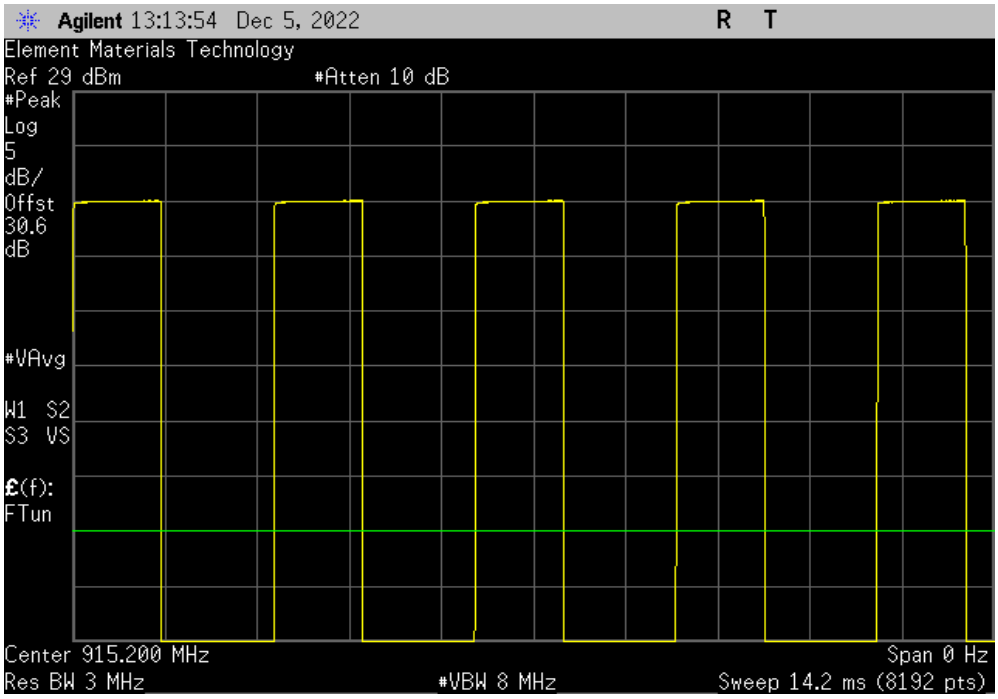


DUTY CYCLE

Single Channe - Low Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.35 ms	3.1 ms	1	43.6	N/A	N/A

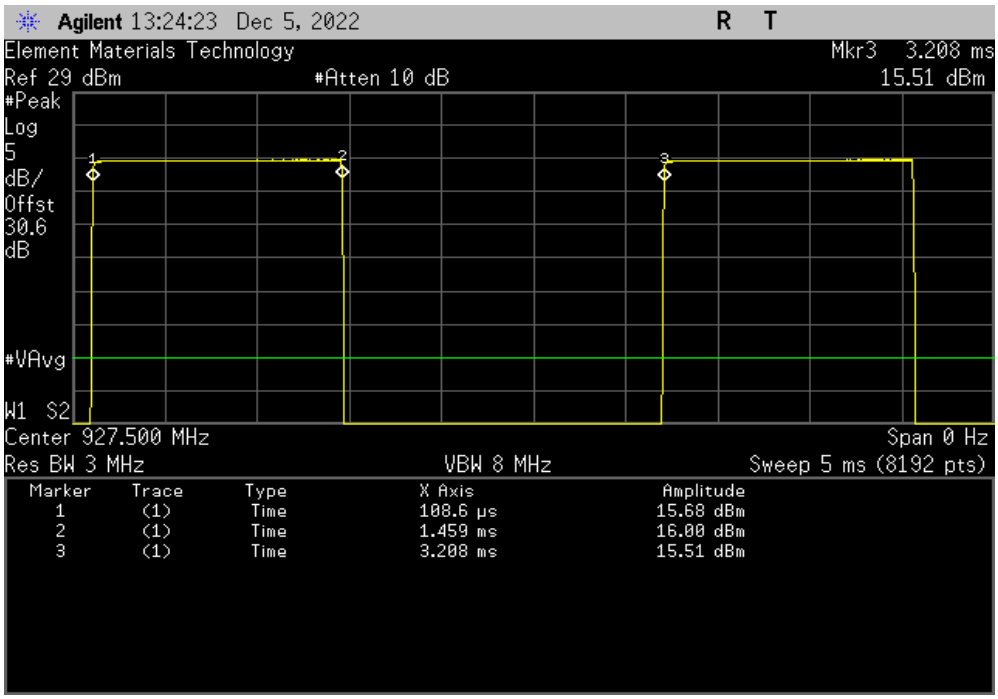


Single Channe - Low Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

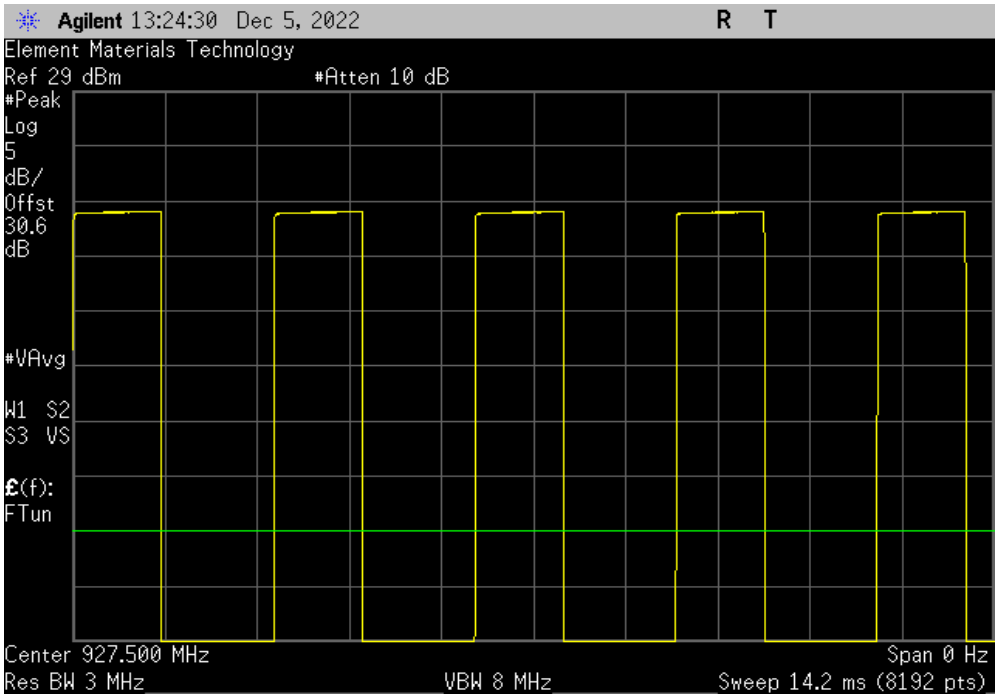


DUTY CYCLE

Single Channe - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.351 ms	3.1 ms	1	43.6	N/A	N/A



Single Channe - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



CARRIER FREQUENCY SEPARATION

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The channel carrier frequencies in the 902-928 MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.

CARRIER FREQUENCY SEPARATION

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.2 °C**
Attendees:	**Erik Floden**			**Humidity:**	**36.1% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable. The 20 dB bandwidth of the hopping channel is 210 kHz.

DEVIATIONS FROM TEST STANDARD

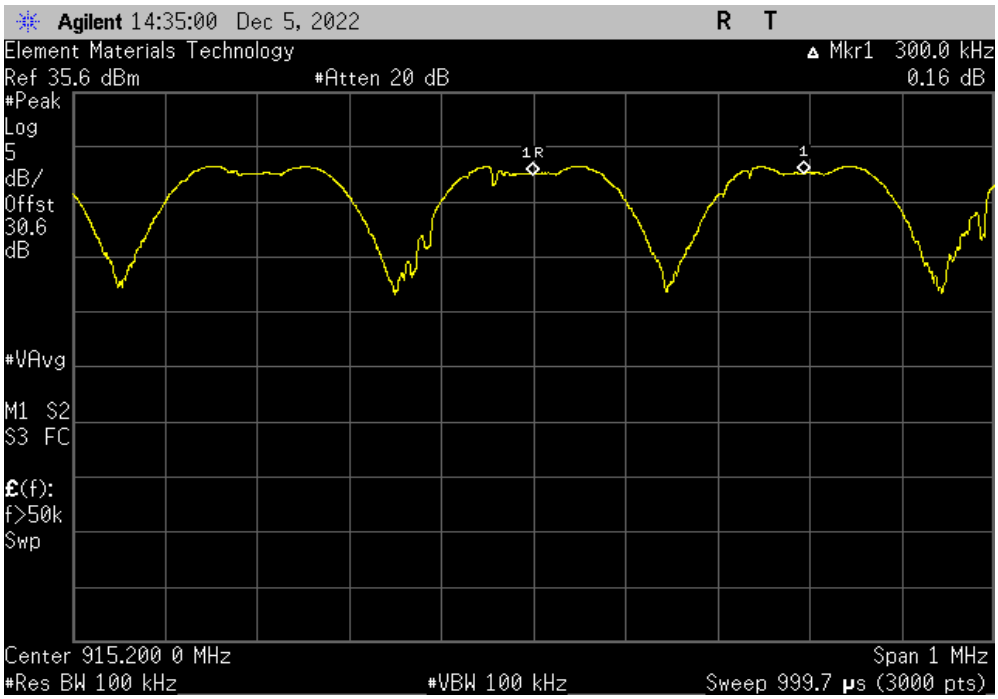
None

Configuration #	**1**	*Signature*

	Value	**Limit (≥)**	**Results**
Hopping - High Power Mode			
Mid Channel, 915.2 MHz	300 kHz	210 kHz	Pass

CARRIER FREQUENCY SEPARATION

Hopping - High Power Mode, Mid Channel, 915.2 MHz						
				Value	Limit (≥)	Results
				300 kHz	210 kHz	Pass



NUMBER OF HOPPING FREQUENCIES

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The number of hopping frequencies was measured across the authorized band. The hopping function of the EUT was enabled.

The 20 dB bandwidth of the hopping channel is less than 250 kHz. The system shall use at least 50 hopping frequencies.

NUMBER OF HOPPING FREQUENCIES

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.2 °C**
Attendees:	**Erik Floden**			**Humidity:**	**36.1% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

DEVIATIONS FROM TEST STANDARD

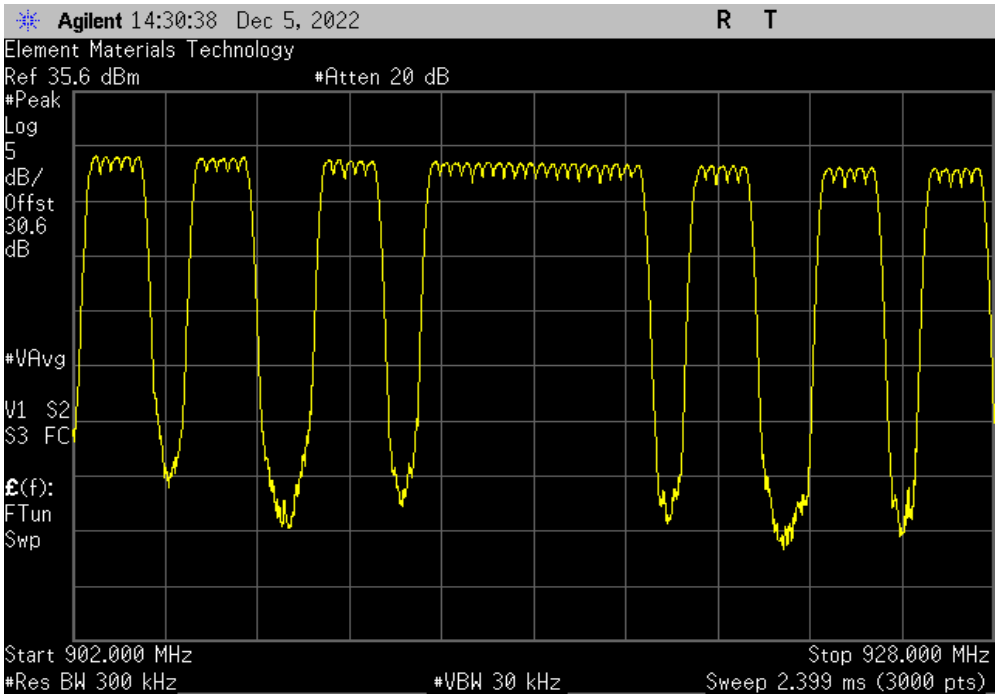
None

Configuration #	**1**	*Signature*

	Number of Channels	**Limit (≥)**	**Results**
Hopping - High Power Mode			
Mid Channel, 915.2 MHz	50	50	Pass

NUMBER OF HOPPING FREQUENCIES

Hopping - High Power Mode, Mid Channel, 915.2 MHz						
				Number of Channels	Limit (≥)	Results
				50	50	Pass



DWELL TIME

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band.
The hopping function of the EUT was enabled.

The dwell time limit is based on the Number of Hopping Channels * 400 mS. For the EUT this would be:

50 Channels * 400mS = 20 s

On time during 20 Sec = Pulse Width * Average Number of Pulses * Scale Factor

Average Number of Pulses is based on 4 samples.

Scale Factor = 20 Sec / Screen Capture Sweep Time = 20 Sec / 4 Sec = 5

DWELL TIME

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.2 °C**
Attendees:	**Erik Floden**			**Humidity:**	**35.8% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

DEVIATIONS FROM TEST STANDARD

None

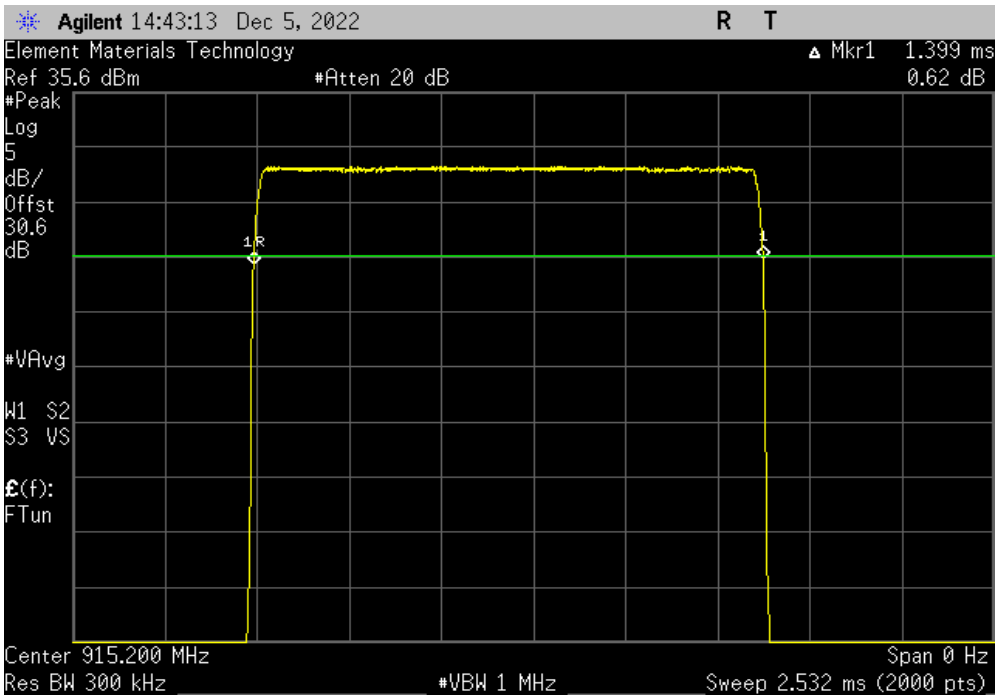
Configuration #	**1**	*Signature*

	Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
Hopping - High Power Mode							
Mid Channel, 915.2 MHz	1.399	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel, 915.2 MHz	N/A	26	N/A	N/A	N/A	N/A	N/A
Mid Channel, 915.2 MHz	N/A	26	N/A	N/A	N/A	N/A	N/A
Mid Channel, 915.2 MHz	N/A	26	N/A	N/A	N/A	N/A	N/A
Mid Channel, 915.2 MHz	N/A	26	N/A	N/A	N/A	N/A	N/A
Mid Channel, 915.2 MHz	1.399	N/A	26	5	181.87	400	Pass

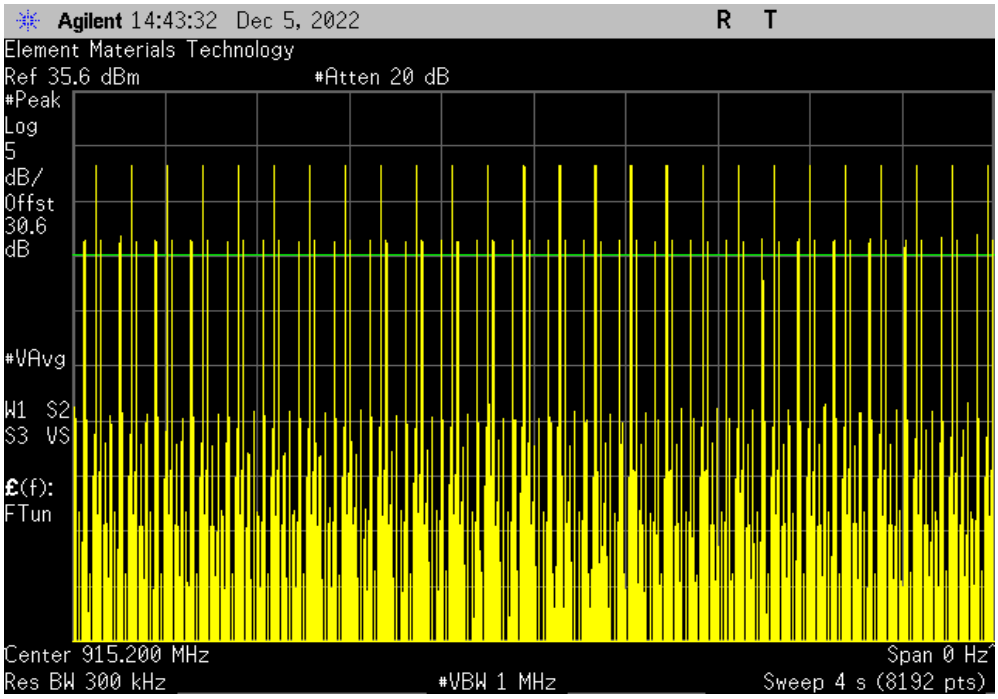
DWELL TIME

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping - High Power Mode, Mid Channel, 915.2 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
1.399	N/A	N/A	N/A	N/A	N/A	N/A



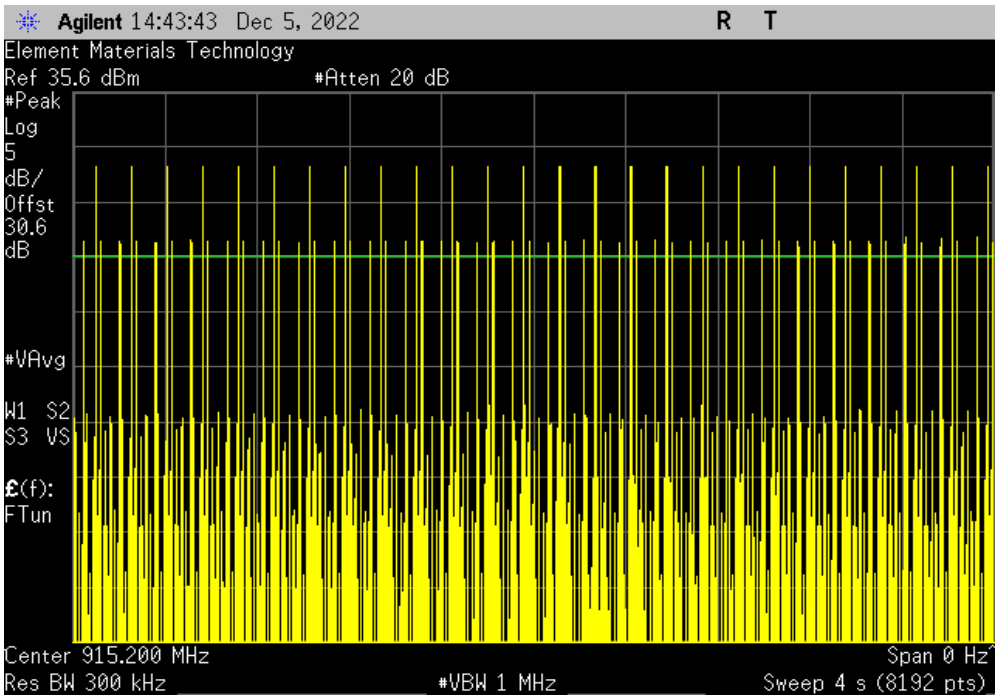
Hopping - High Power Mode, Mid Channel, 915.2 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
N/A	26	N/A	N/A	N/A	N/A	N/A



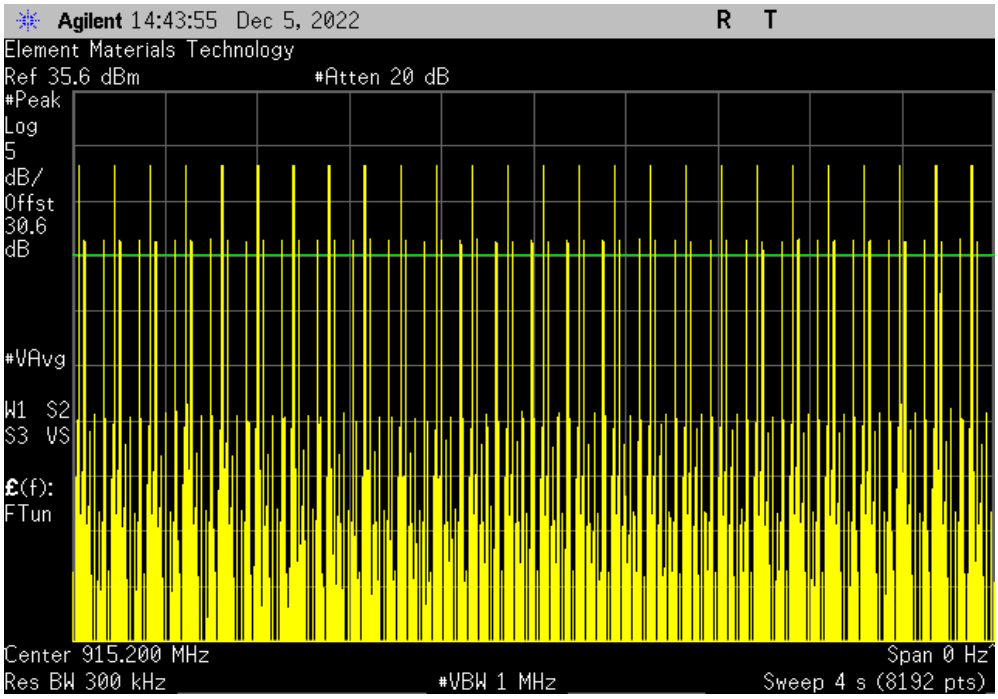
DWELL TIME

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping - High Power Mode, Mid Channel, 915.2 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
N/A	26	N/A	N/A	N/A	N/A	N/A



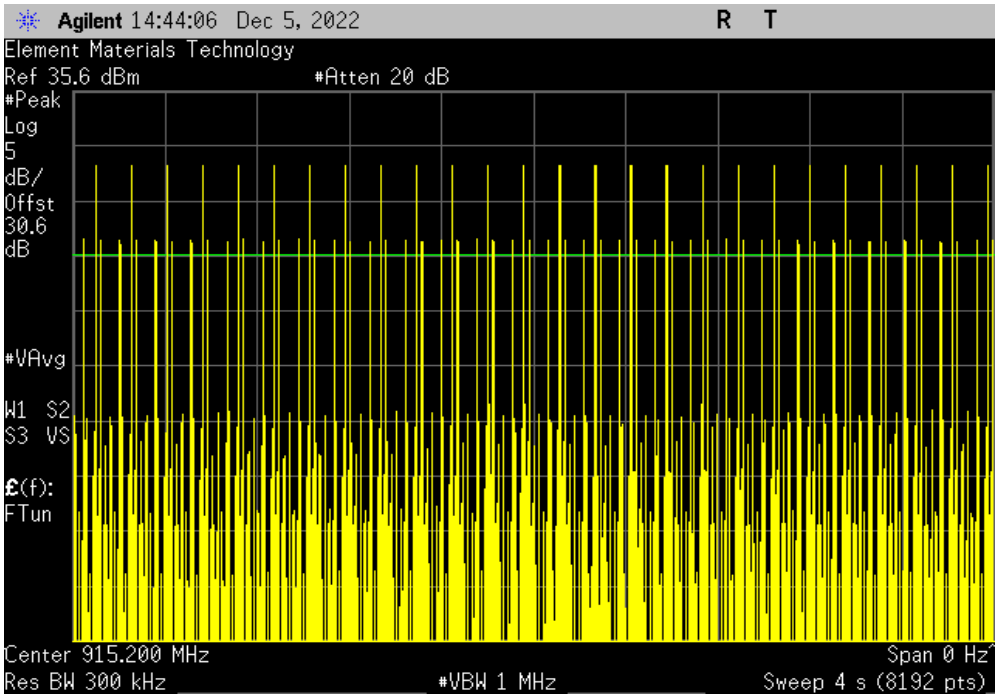
Hopping - High Power Mode, Mid Channel, 915.2 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
N/A	26	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2022.06.03.0 XMit 2022.02.07.0

Hopping - High Power Mode, Mid Channel, 915.2 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
N/A	26	N/A	N/A	N/A	N/A	N/A



Hopping - High Power Mode, Mid Channel, 915.2 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 20 s	Limit (ms)	Results
1.399	N/A	26	5	181.87	400	Pass

Calculation Only

No Screen Capture Required

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

Equivalent Isotropic Radiated Power (EIRP) = Max Measured Power + Antenna gain (dBi)

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.2 °C**
Attendees:	**Erik Floden**			**Humidity:**	**36.2% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

The EUT employs professional installation - the installer will use installation instructions provided by the manufacturer to determine the power setting and RF cable loss needed to ensure that the max EIRP of the product does not exceed 36 dBm EIRP. The RF Cable Loss factor is the loss associated with the RF cable connecting the antenna port of the EUT to the external antenna.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**1**	*Signature*

		Out Pwr (dBm)	RF cable loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
High Power Mode							
	GFSK, 200 kbps						
	Low Channel, 902.6 MHz	28.45	1.6	9.15	36.00	36	Pass
	Mid Channel, 915.2 MHz	28.31	1.5	9.15	35.96	36	Pass
	High Channel, 927.5 MHz	28.34	1.5	9.15	35.99	36	Pass
Low Power Mode							
	GFSK, 200 kbps						
	Low Channel, 902.6 MHz	18.76	0	14.15	32.91	36	Pass
	Mid Channel, 915.2 MHz	18.97	0	14.15	33.12	36	Pass
	High Channel, 927.5 MHz	18.71	0	14.15	32.86	36	Pass

OUTPUT POWER

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

OUTPUT POWER

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.1 °C**
Attendees:	**Erik Floden**			**Humidity:**	**34.7% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

DEVIATIONS FROM TEST STANDARD

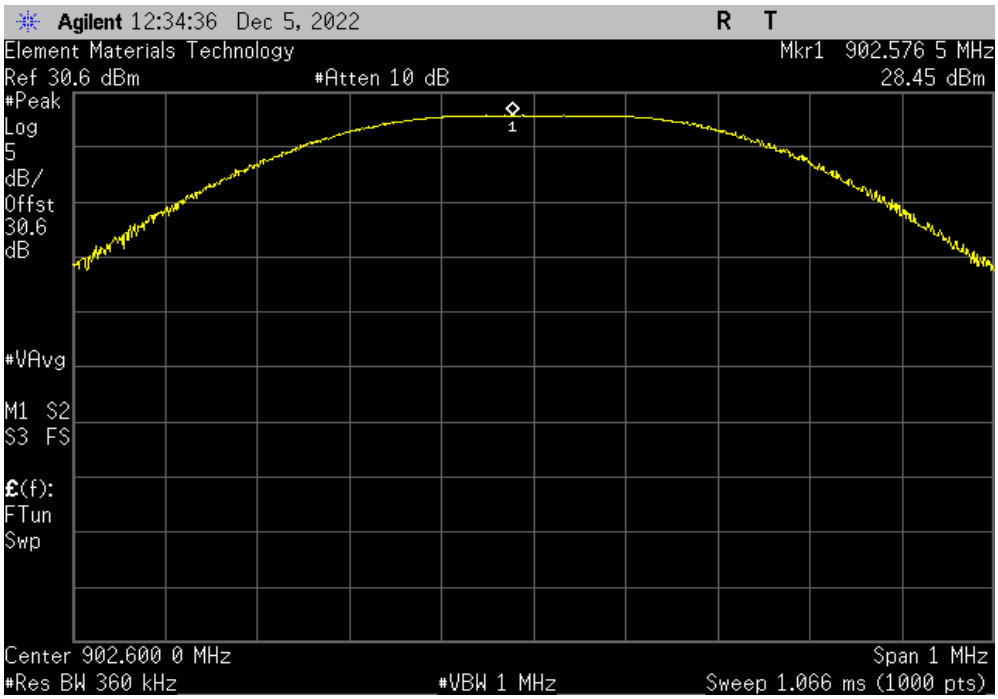
None

Configuration #	**1**	*Signature*

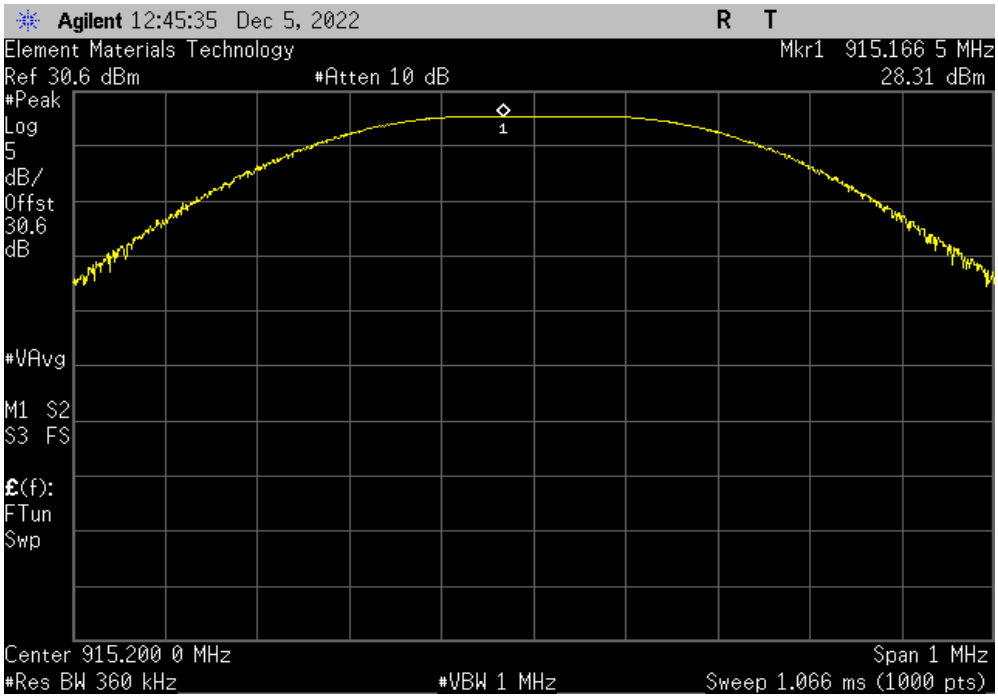
	Out Pwr (dBm)	**Limit (dBm)**	**Result**
Single Channel - High Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	28.452	30	Pass
Mid Channel, 915.2 MHz	28.311	30	Pass
High Channel, 927.5 MHz	28.336	30	Pass
Single Channel - Low Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	18.758	30	Pass
Mid Channel, 915.2 MHz	18.973	30	Pass
High Channel, 927.5 MHz	18.714	30	Pass

OUTPUT POWER

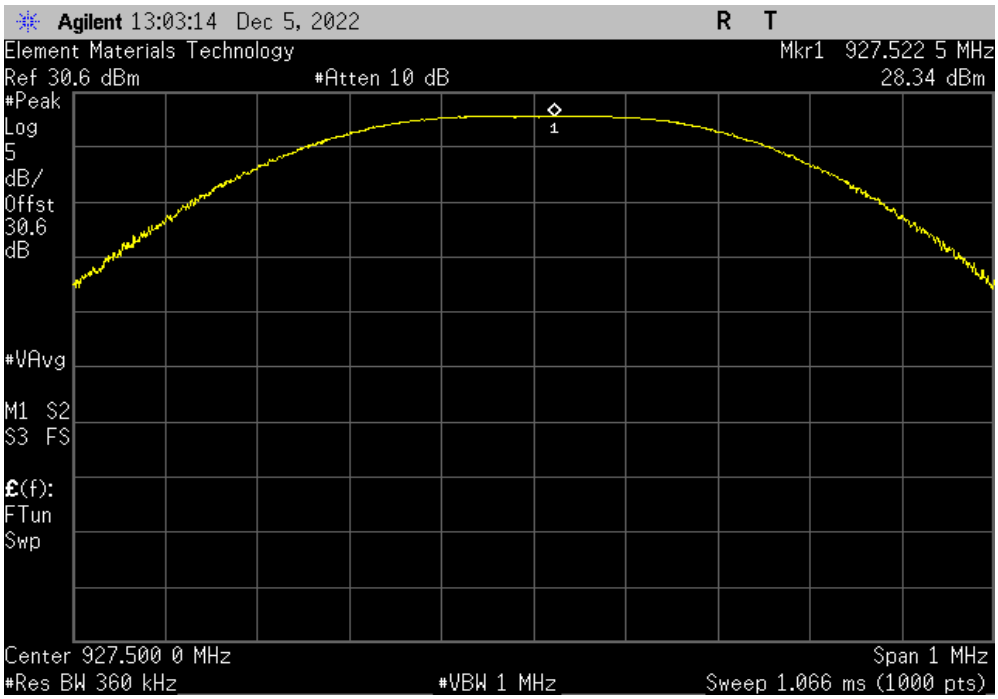
Single Channel - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				28.452	30	Pass



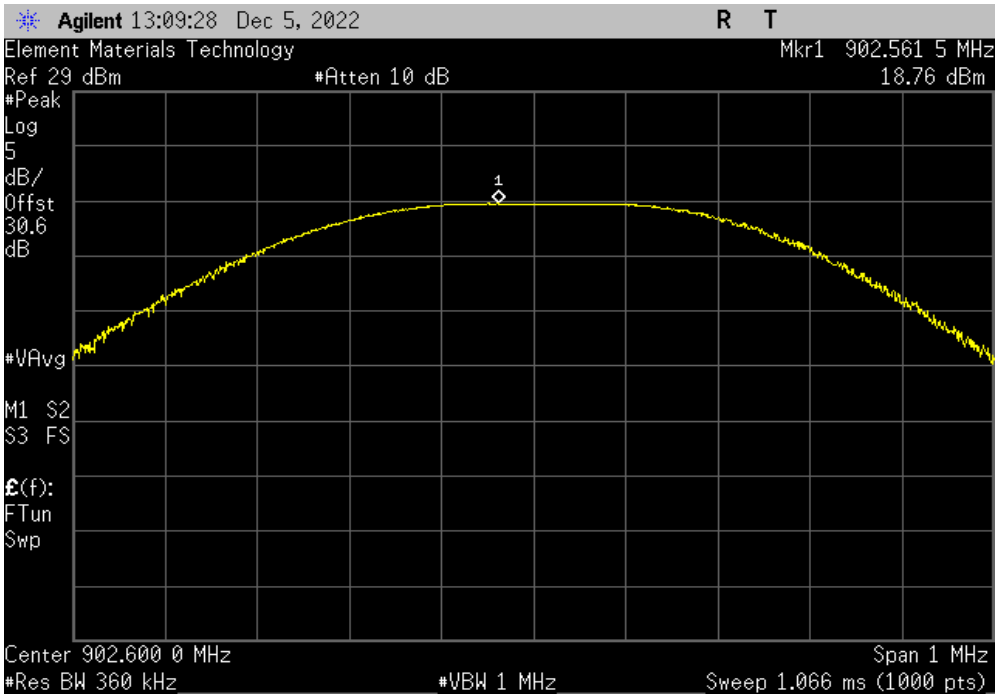
Single Channel - High Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				28.311	30	Pass



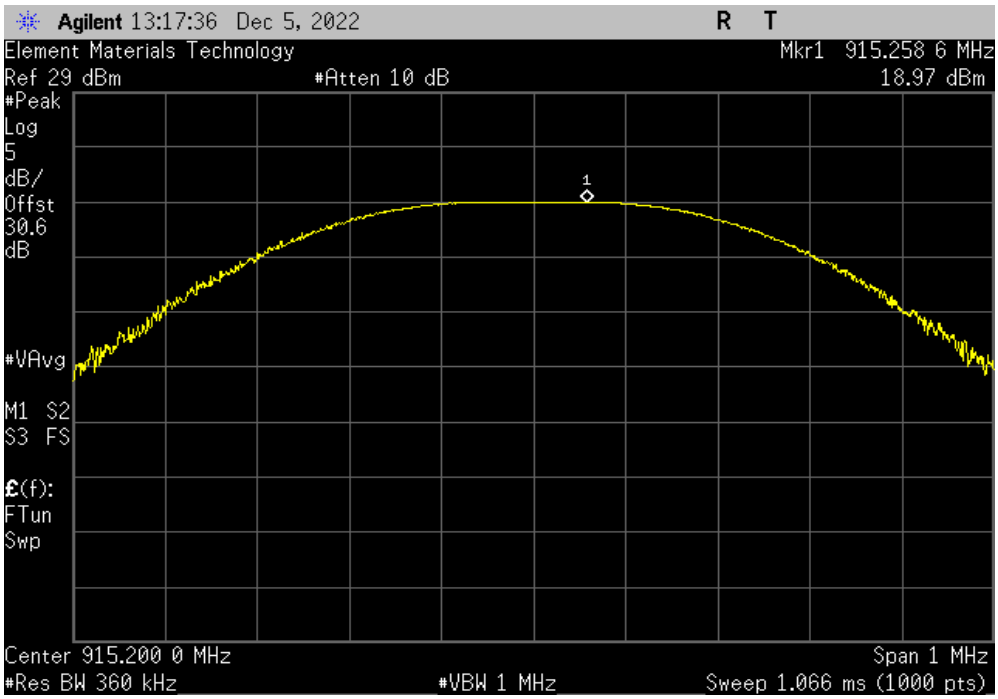
Single Channel - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				28.336	30	Pass



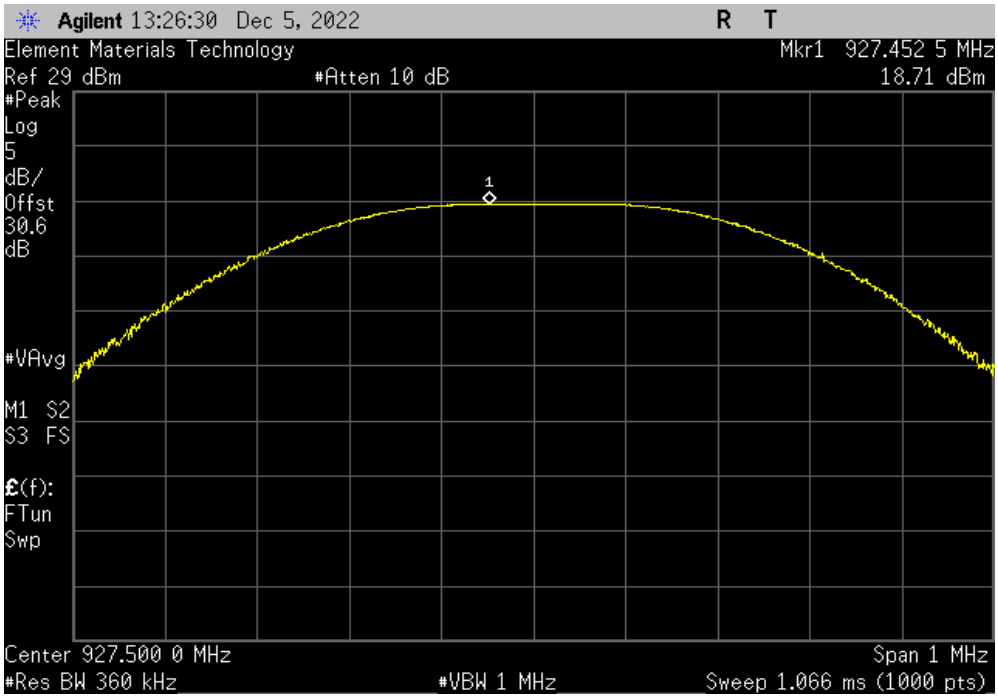
Single Channel - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				18.758	30	Pass



Single Channel - Low Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				18.973	30	Pass



Single Channel - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				18.714	30	Pass



BAND EDGE COMPLIANCE

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet in a no hop mode. The channels closest to the band edges were selected.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20 °C**
Attendees:	**Erik Floden**			**Humidity:**	**34.7% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

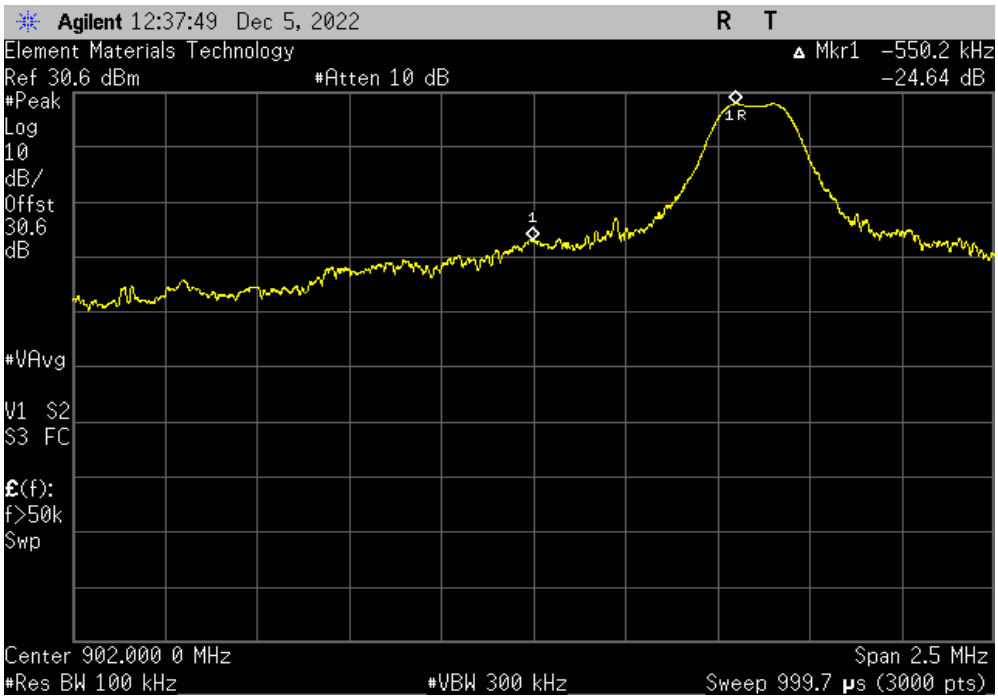
DEVIATIONS FROM TEST STANDARD

None

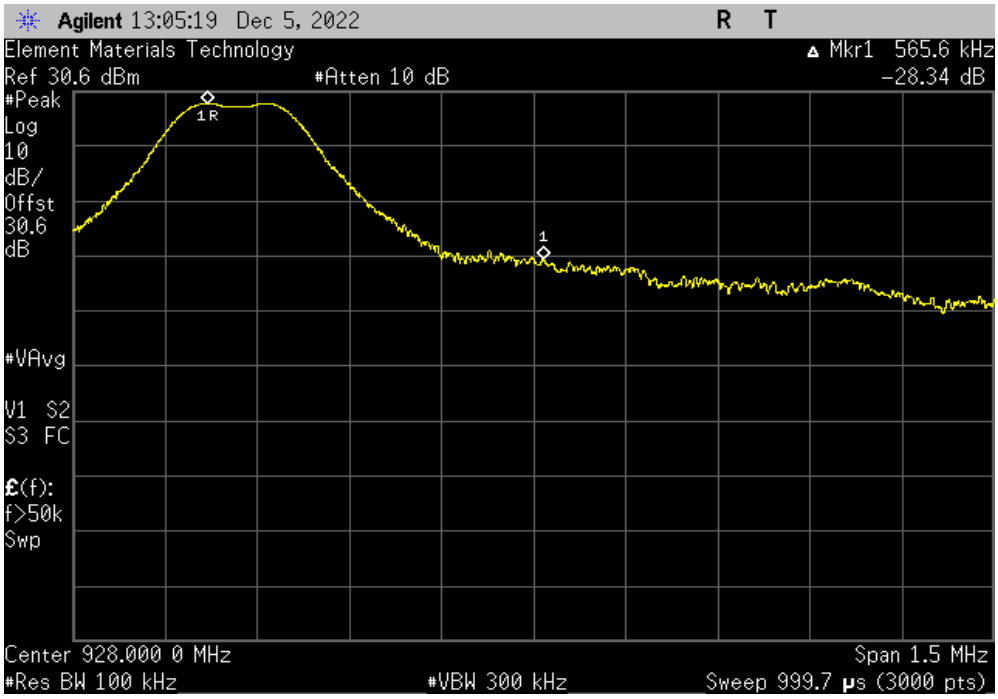
Configuration #	**1**	*Signature*

	Value (dBc)	**Limit ≤ (dBc)**	**Result**
Single Channel - High Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	-24.64	-20	Pass
High Channel, 927.5 MHz	-28.34	-20	Pass
Single Channel - Low Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	-24.78	-20	Pass
High Channel, 927.5 MHz	-28.38	-20	Pass

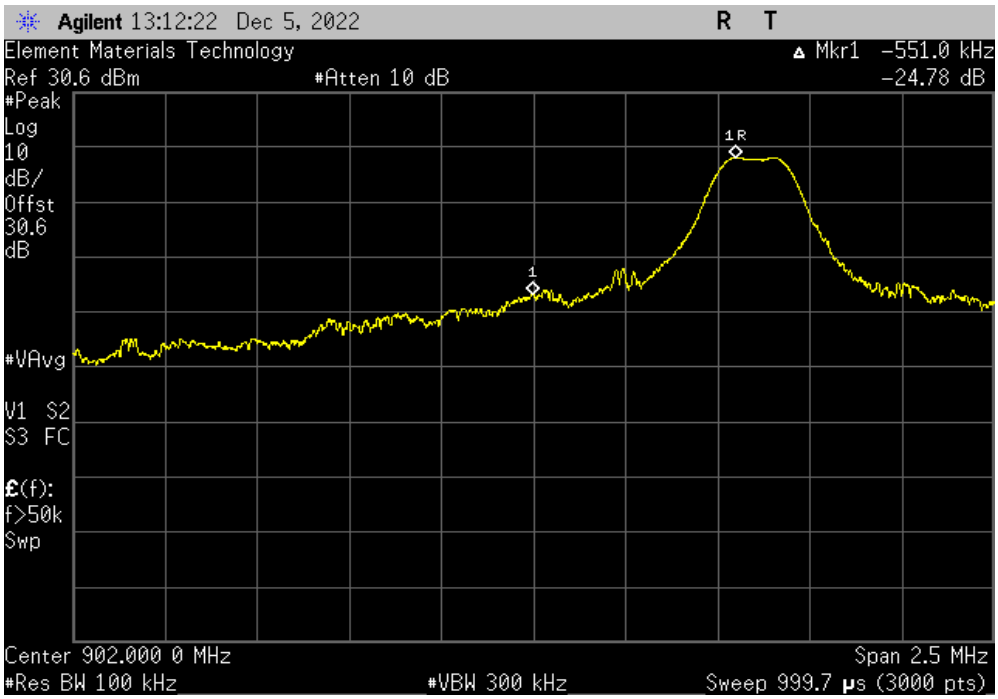
Single Channel - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-24.64	-20	Pass



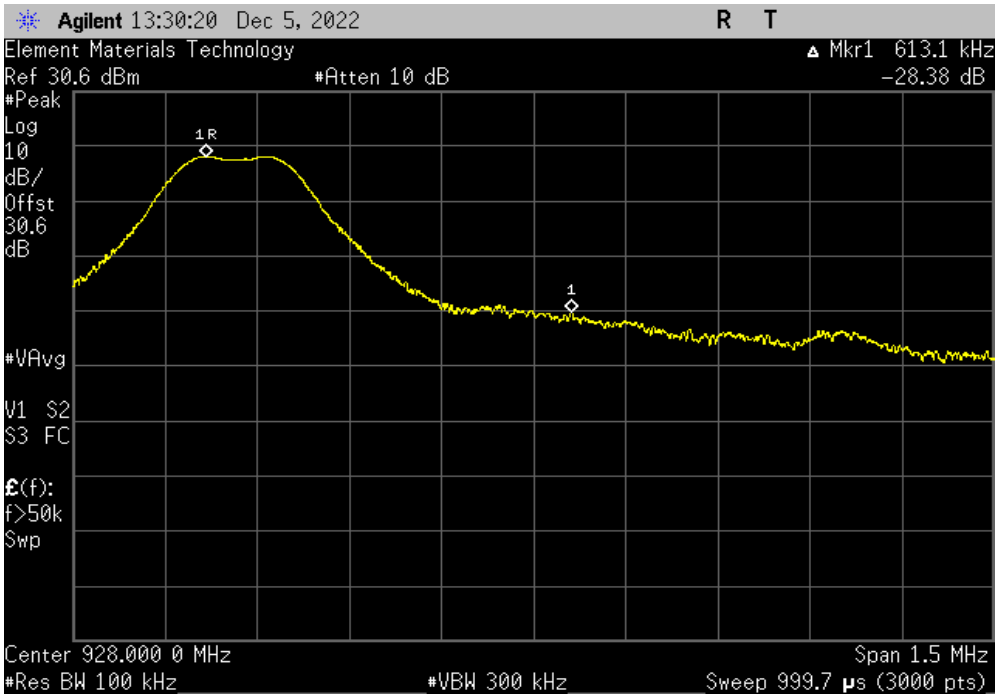
Single Channel - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-28.34	-20	Pass



Single Channel - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-24.78	-20	Pass



Single Channel - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-28.38	-20	Pass



BAND EDGE COMPLIANCE - HOPPING MODE

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-03-14
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to its normal pseudo-random hopping sequence. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE - HOPPING MODE

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.2 °C**
Attendees:	**Erik Floden**			**Humidity:**	**36.1% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

DEVIATIONS FROM TEST STANDARD

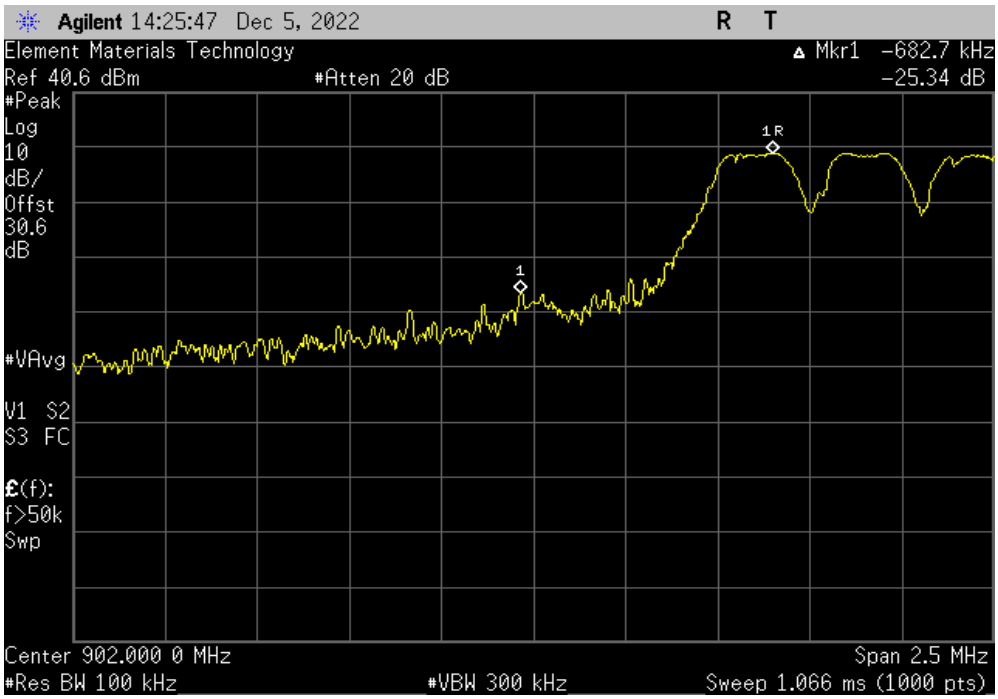
None

Configuration #	**1**	*Signature*

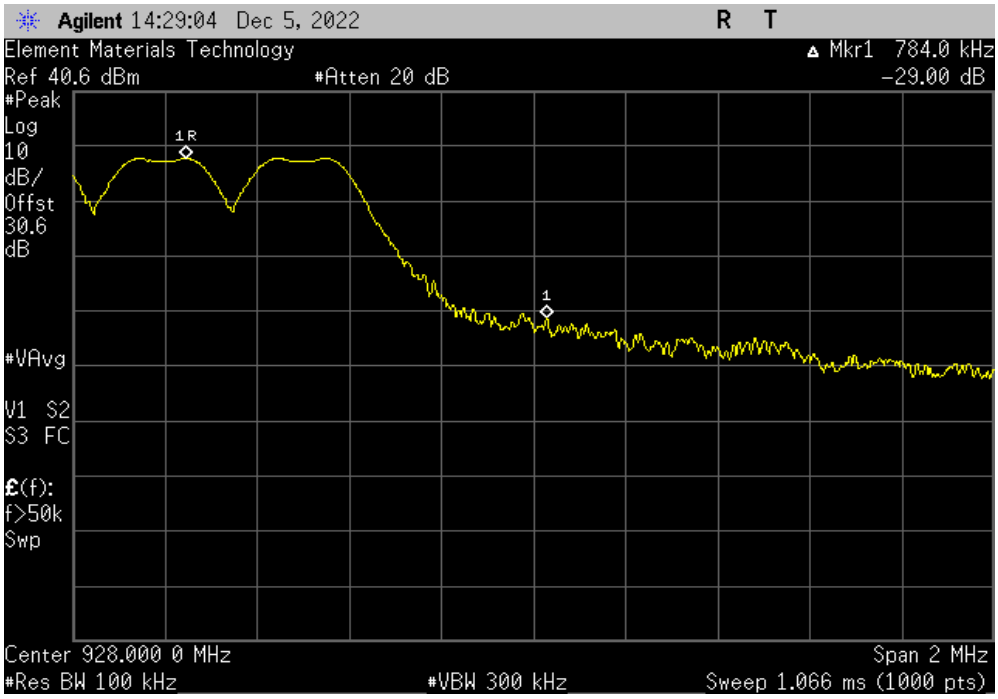
	Value (dBc)	**Limit ≤ (dBc)**	**Result**
Hopping - High Power Mode			
Low Channel, 902.6 MHz	-25.35	-20	Pass
High Channel, 927.5 MHz	-29	-20	Pass

BAND EDGE COMPLIANCE - HOPPING MODE

Hopping - High Power Mode, Low Channel, 902.6 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-25.35	-20	Pass



Hopping - High Power Mode, High Channel, 927.5 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-29	-20	Pass



EMISSIONS BANDWIDTH (dB)

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The 20 dB emissions bandwidth was measured with the EUT set to low, medium and high transmit frequencies in the band. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

EMISSIONS BANDWIDTH (dB)

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20 °C**
Attendees:	**Erik Floden**			**Humidity:**	**34.6% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

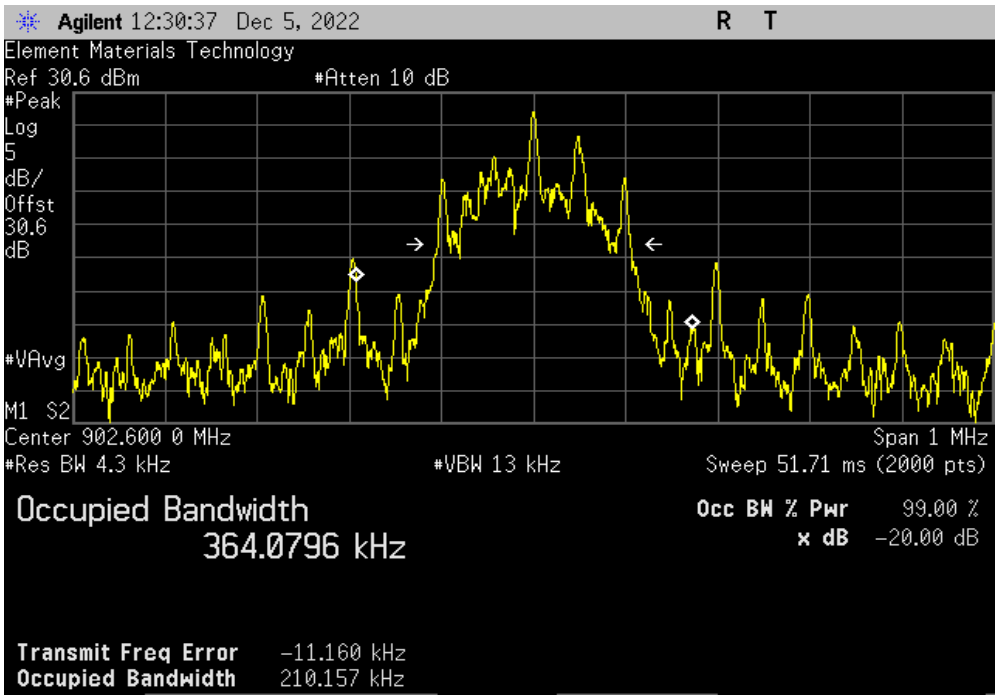
DEVIATIONS FROM TEST STANDARD

None

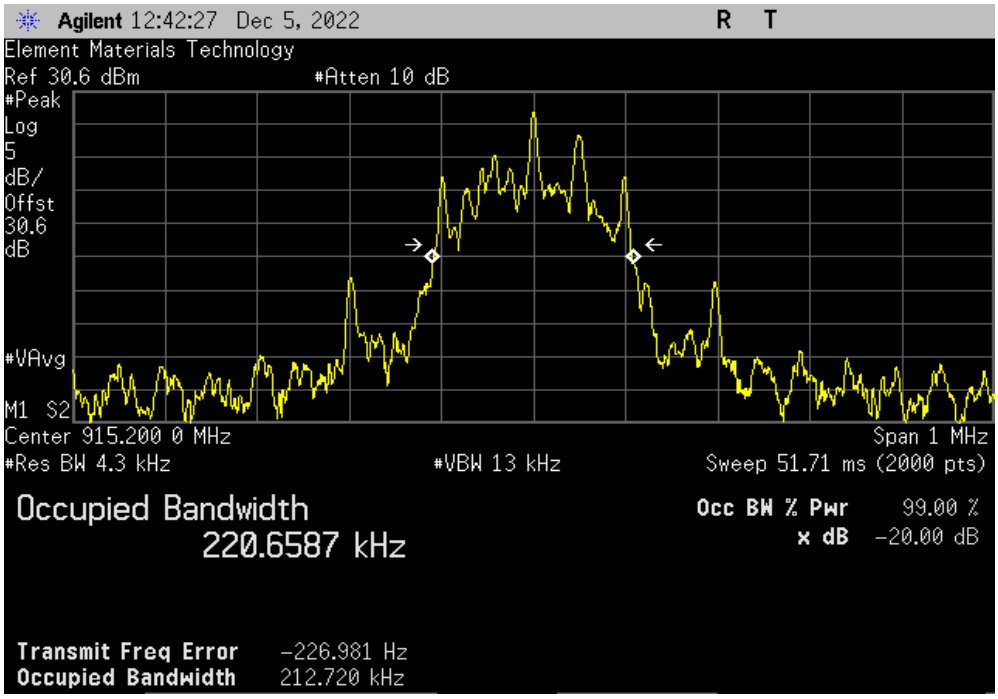
Configuration #	**1**	*Signature*

	Value	**Limit (<)**	**Result**
Single Channel - High Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	210.157 kHz	1.5 MHz	Pass
Mid Channel, 915.2 MHz	212.72 kHz	1.5 MHz	Pass
High Channel, 927.5 MHz	214.295 kHz	1.5 MHz	Pass
Single Channel - Low Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	211.307 kHz	1.5 MHz	Pass
Mid Channel, 915.2 MHz	212.4 kHz	1.5 MHz	Pass
High Channel, 927.5 MHz	211.497 kHz	1.5 MHz	Pass

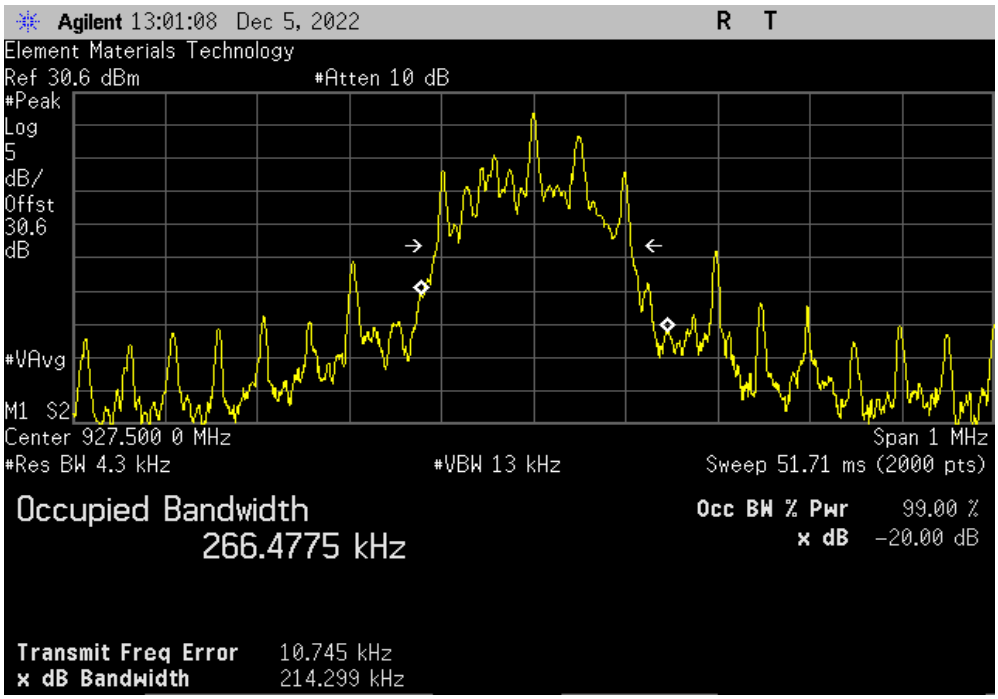
Single Channel - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Value	Limit (<)	Result
				210.157 kHz	1.5 MHz	Pass



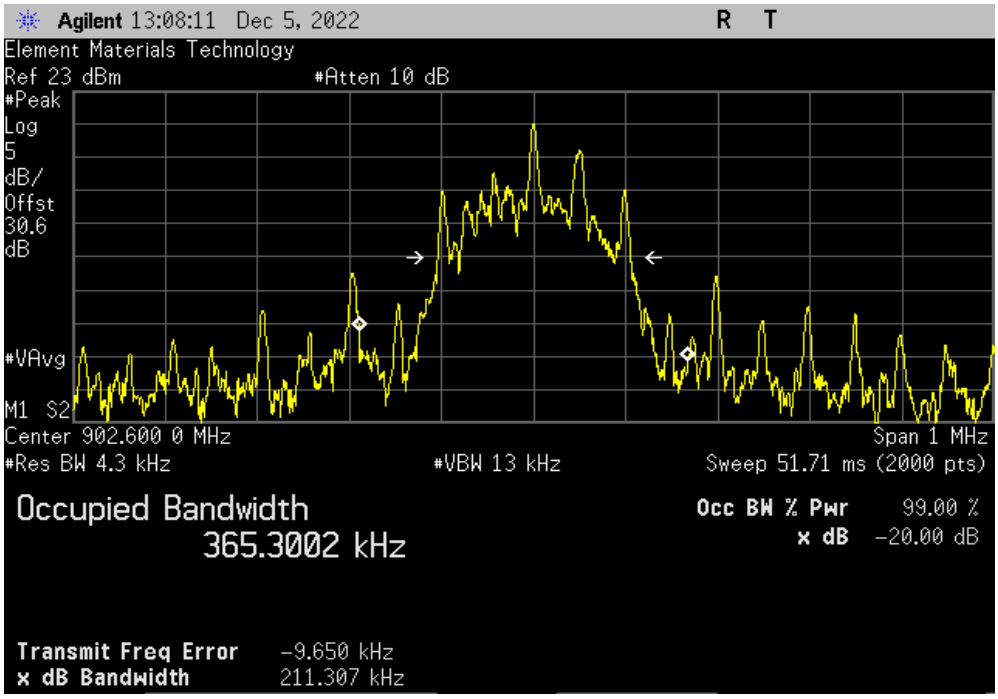
Single Channel - High Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
				Value	Limit (<)	Result
				212.72 kHz	1.5 MHz	Pass



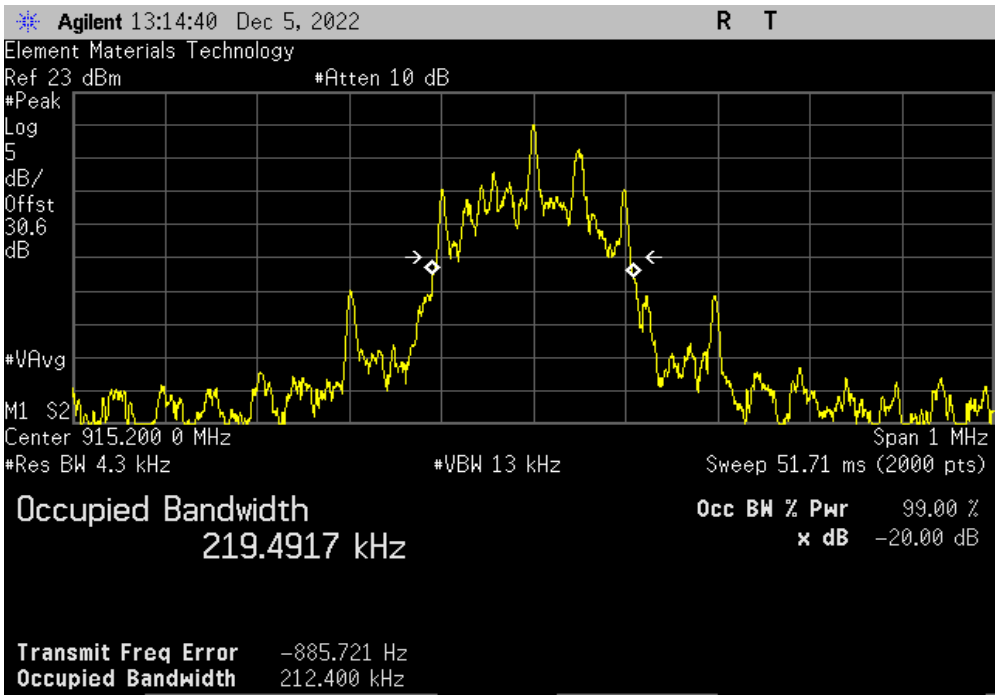
Single Channel - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Value	Limit (<)	Result
				214.295 kHz	1.5 MHz	Pass



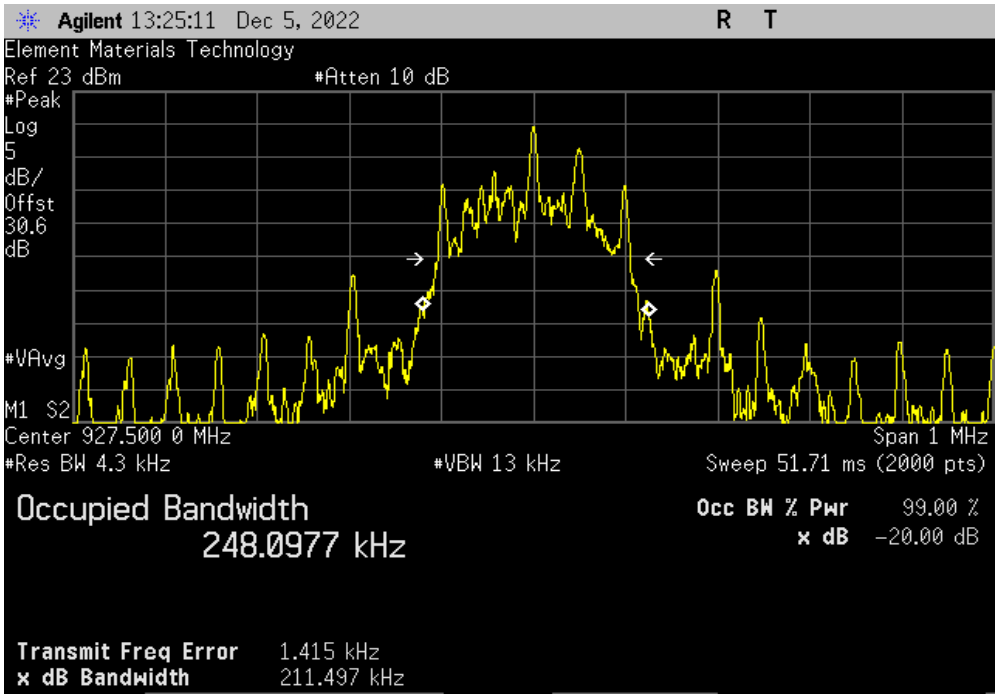
Single Channel - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Value	Limit (<)	Result
				211.307 kHz	1.5 MHz	Pass



Single Channel - Low Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
				Value	Limit (<)	Result
				212.4 kHz	1.5 MHz	Pass



Single Channel - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Value	Limit (<)	Result
				211.497 kHz	1.5 MHz	Pass



OCCUPIED BANDWIDTH (99%)

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The 99% occupied bandwidth was measured with the EUT configured for continuous modulated operation.

Per ANSI C63.10:2013, 6.9.3, the spectrum analyzer was configured as follows:

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto to prevent video filtering or averaging. A sample detector was used unless the device was not able to be operated in a continuous transmit mode, in which case a peak detector was used.

The spectrum analyzer occupied bandwidth measurement function was used to sum the power of the transmission in linear terms to obtain the 99% bandwidth.

OCCUPIED BANDWIDTH (99%)

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20 °C**
Attendees:	**Erik Floden**			**Humidity:**	**34.7% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

DEVIATIONS FROM TEST STANDARD

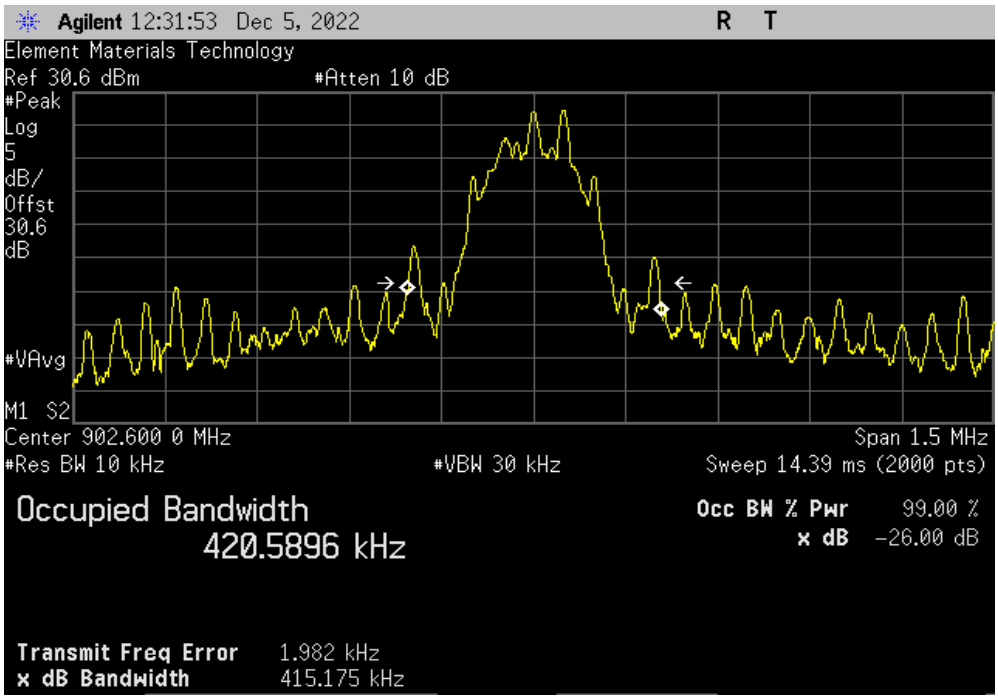
None

Configuration #	**1**	*Signature*

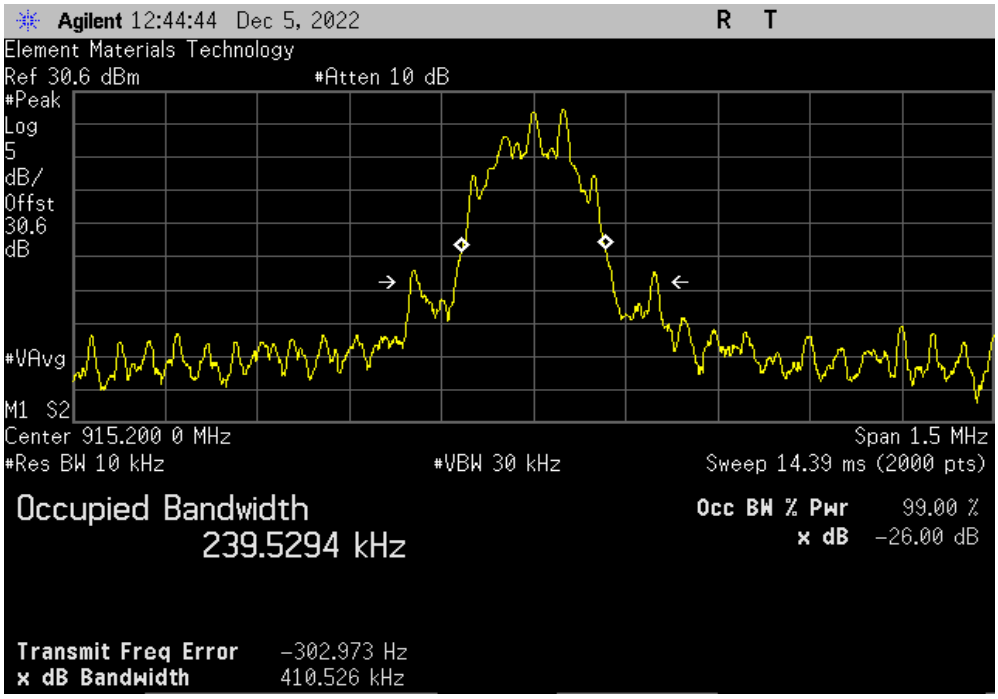
	Value	**Limit**	**Result**
Single Channel - High Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	419.446 kHz	N/A	N/A
Mid Channel, 915.2 MHz	239.485 kHz	N/A	N/A
High Channel, 927.5 MHz	277.977 kHz	N/A	N/A
Single Channel - Low Power Mode			
GFSK, 200 kbps			
Low Channel, 902.6 MHz	412.442 kHz	N/A	N/A
Mid Channel, 915.2 MHz	239.663 kHz	N/A	N/A
High Channel, 927.5 MHz	290.488 kHz	N/A	N/A

OCCUPIED BANDWIDTH (99%)

Single Channel - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Value	Limit	Result
				419.446 kHz	N/A	N/A

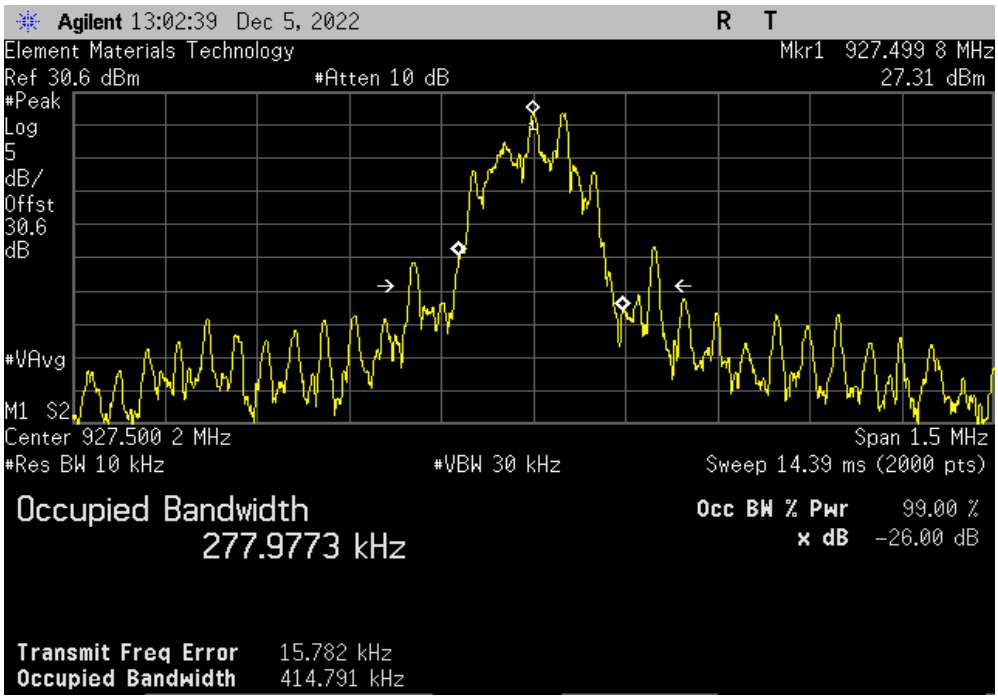


Single Channel - High Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
				Value	Limit	Result
				239.485 kHz	N/A	N/A

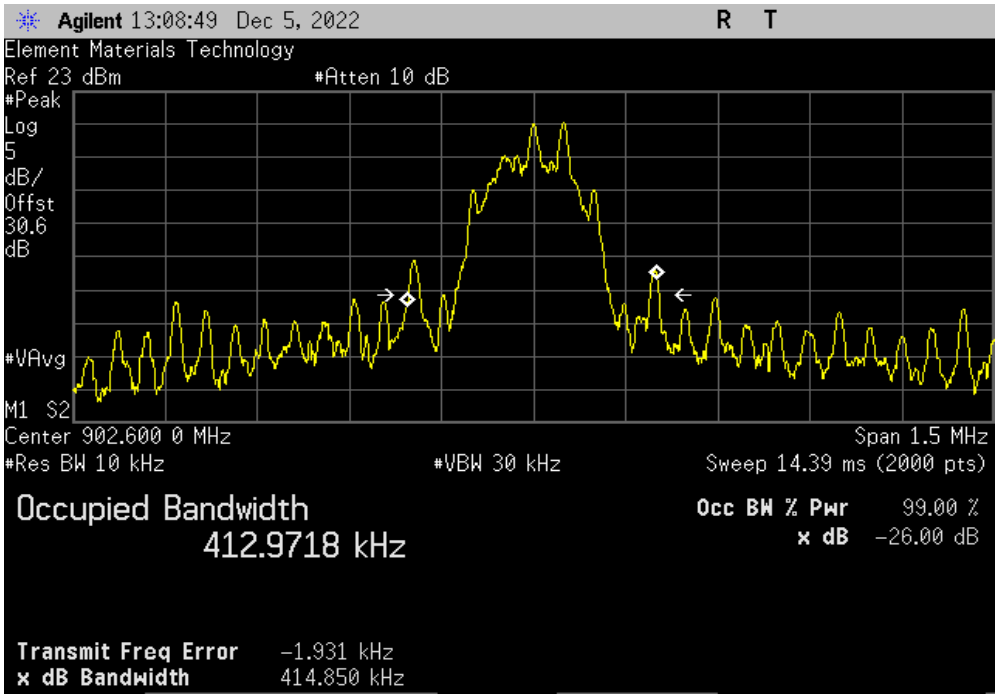


OCCUPIED BANDWIDTH (99%)

Single Channel - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Value	Limit	Result
				277.977 kHz	N/A	N/A

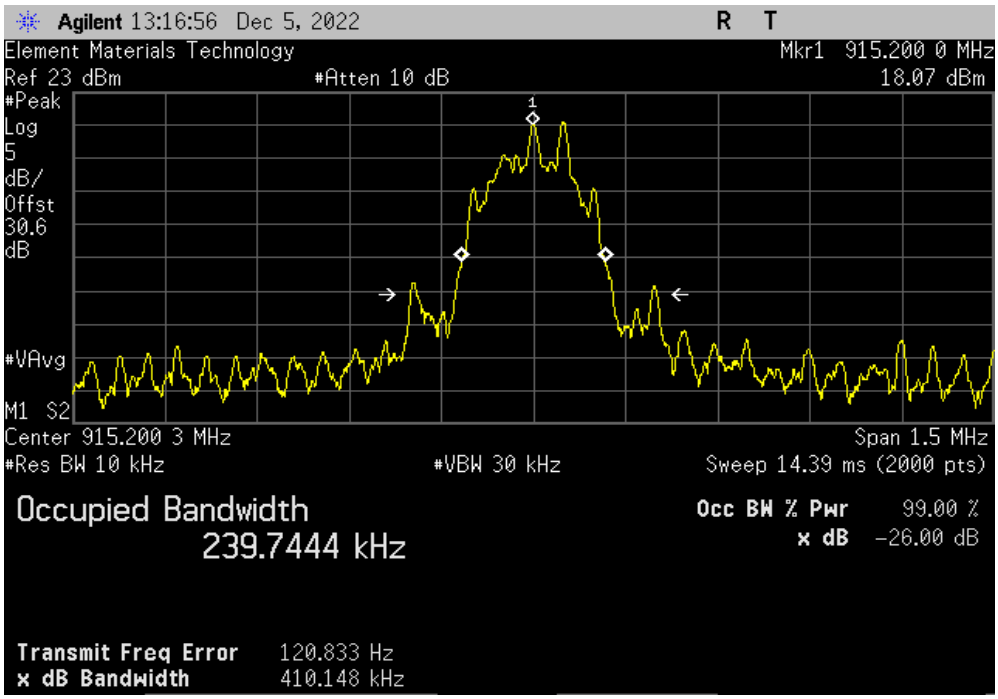


Single Channel - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
				Value	Limit	Result
				412.442 kHz	N/A	N/A

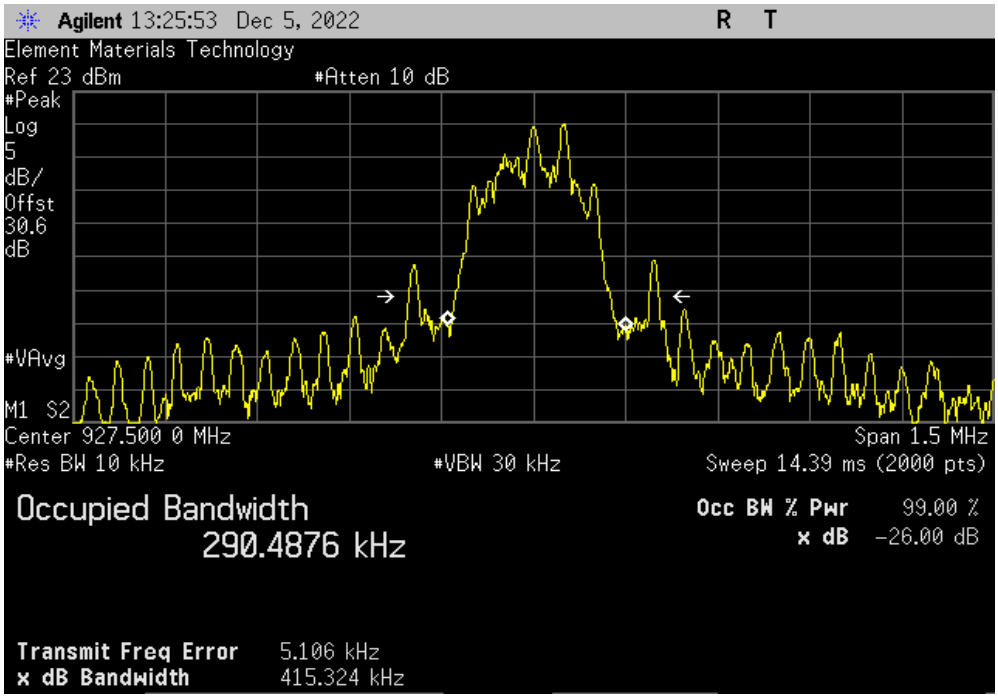


OCCUPIED BANDWIDTH (99%)

Single Channel - Low Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz						
				Value	Limit	Result
				239.663 kHz	N/A	N/A



Single Channel - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz						
				Value	Limit	Result
				290.488 kHz	N/A	N/A



SPURIOUS CONDUCTED EMISSIONS

XMit 2022.02.07.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	N5181A	TIG	2020-04-16	2023-04-16
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	2022-03-14	2023-03-14
Attenuator	Fairview Microwave	SA26B-10	TWH	2022-03-15	2023-03-15
Attenuator	S.M. Electronics	SA26B-20	AUY	2022-03-15	2023-03-15
Block - DC	Fairview Microwave	SD3379	AMW	2022-03-14	2023-03-14
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2022-01-26	2023-01-26

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode. For each transmit frequency, the fundamental was measured with a 100 kHz resolution bandwidth and the highest value was recorded. The rest of the spectrum was then measured with a 100 kHz resolution bandwidth and the highest value was found. The difference between the value found on the fundamental and the rest of the spectrum was compared against the limit to determine compliance.

The reference level offset for the fundamental screen capture was based on a measured value of the loss between the spectrum analyzer and the EUT which was verified at the time of test. The remaining screen capture(s) use an internal transducer factor on the analyzer to correct the displayed trace based on the cable loss over frequency. The reference level offset for the additional screen capture(s) is then based on the expected attenuator value and any other losses.

Fundamental Offset = Ref Lvl Offset showing measured composite factor of all losses

Remaining Screen capture(s) Offset = “Internal” cable loss factor not shown on screen capture + Ref Lvl Offset showing expected attenuator value and any other losses

SPURIOUS CONDUCTED EMISSIONS

element

TbtTx 2022.06.03.0 XMit 2022.02.07.0

EUT:	**SEL-3031R**			**Work Order:**	**SCHW0252**
Serial Number:	**See configuration**			**Date:**	**5-Dec-22**
Customer:	**Schweitzer Engineering Laboratories, Inc.**			**Temperature:**	**20.1 °C**
Attendees:	**Erik Floden**			**Humidity:**	**34.7% RH**
Project:	**None**			**Barometric Pres.:**	**1018 mbar**
Tested by:	**Jeff Alcoke**	**Power:**	**15 VDC**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2022	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Reference level offset includes: DC block, 30 dB attenuation, and measurement cable.

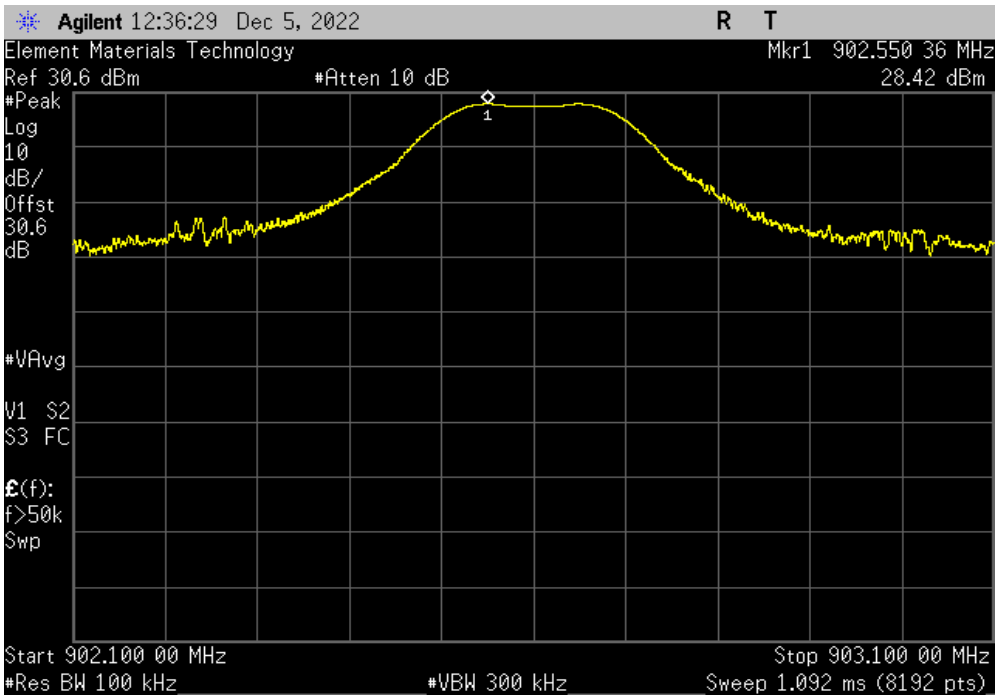
DEVIATIONS FROM TEST STANDARD

None

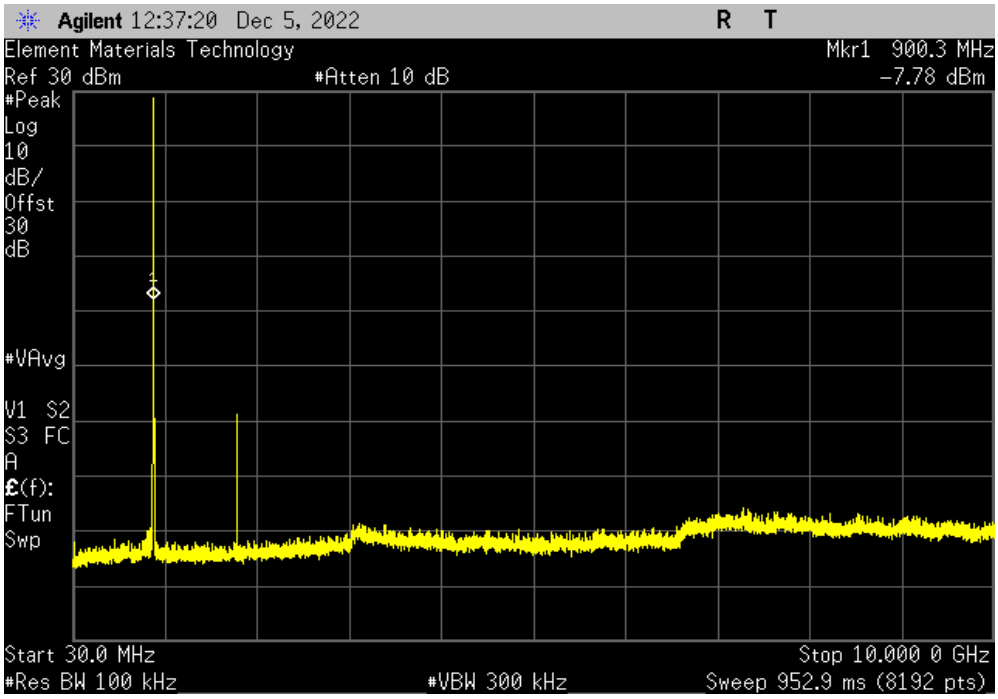
Configuration #	**1**	*Signature*

		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Single Channel - High Power Mode						
	GFSK, 200 kbps					
	Low Channel, 902.6 MHz	Fundamental	902.55	N/A	N/A	N/A
	Low Channel, 902.6 MHz	30 MHz - 10 GHz	900.3	-36.21	-20	Pass
	Mid Channel, 915.2 MHz	Fundamental	915.25	N/A	N/A	N/A
	Mid Channel, 915.2 MHz	30 MHz - 10 GHz	1830.2	-68.41	-20	Pass
	High Channel, 927.5 MHz	Fundamental	927.45	N/A	N/A	N/A
	High Channel, 927.5 MHz	30 MHz - 10 GHz	929.5	-38.03	-20	Pass
Single Channel - Low Power Mode						
	GFSK, 200 kbps					
	Low Channel, 902.6 MHz	Fundamental	902.55	N/A	N/A	N/A
	Low Channel, 902.6 MHz	30 MHz - 10 GHz	900.3	-35.73	-20	Pass
	Mid Channel, 915.2 MHz	Fundamental	915.15	N/A	N/A	N/A
	Mid Channel, 915.2 MHz	30 MHz - 10 GHz	1830.2	-64.33	-20	Pass
	High Channel, 927.5 MHz	Fundamental	927.45	N/A	N/A	N/A
	High Channel, 927.5 MHz	30 MHz - 10 GHz	929.5	-37.17	-20	Pass

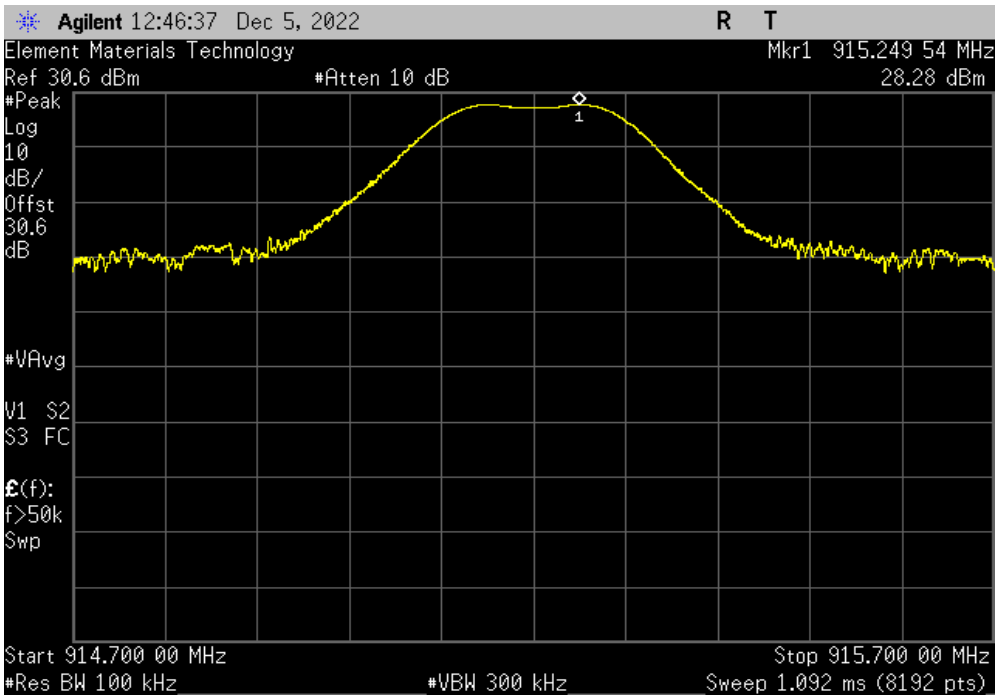
Single Channel - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	902.55	N/A	N/A	N/A



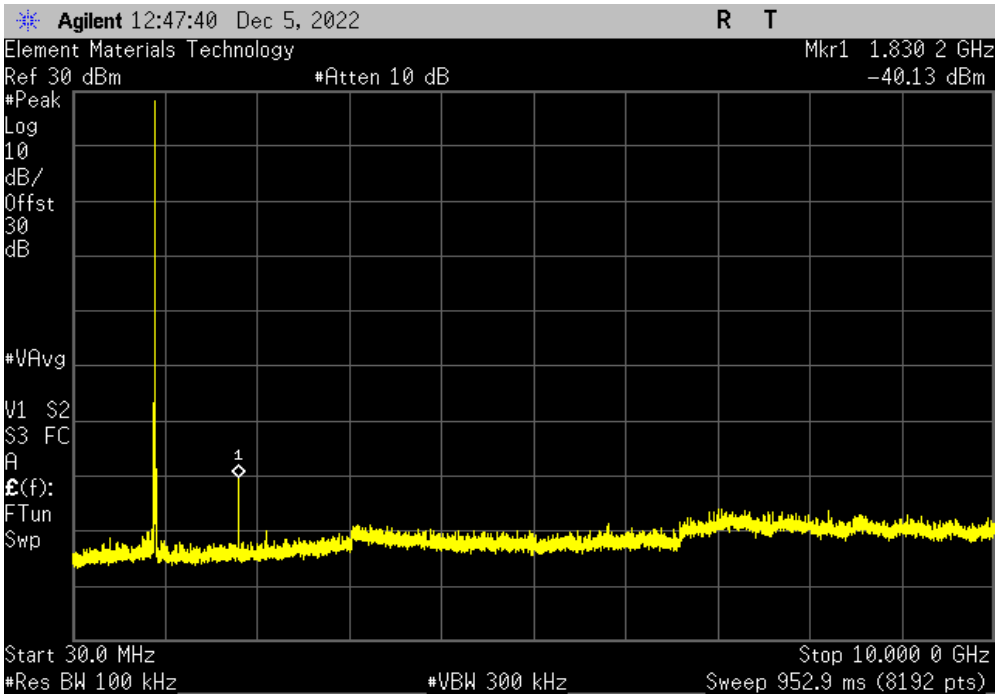
Single Channel - High Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz	900.3	-36.21	-20	Pass



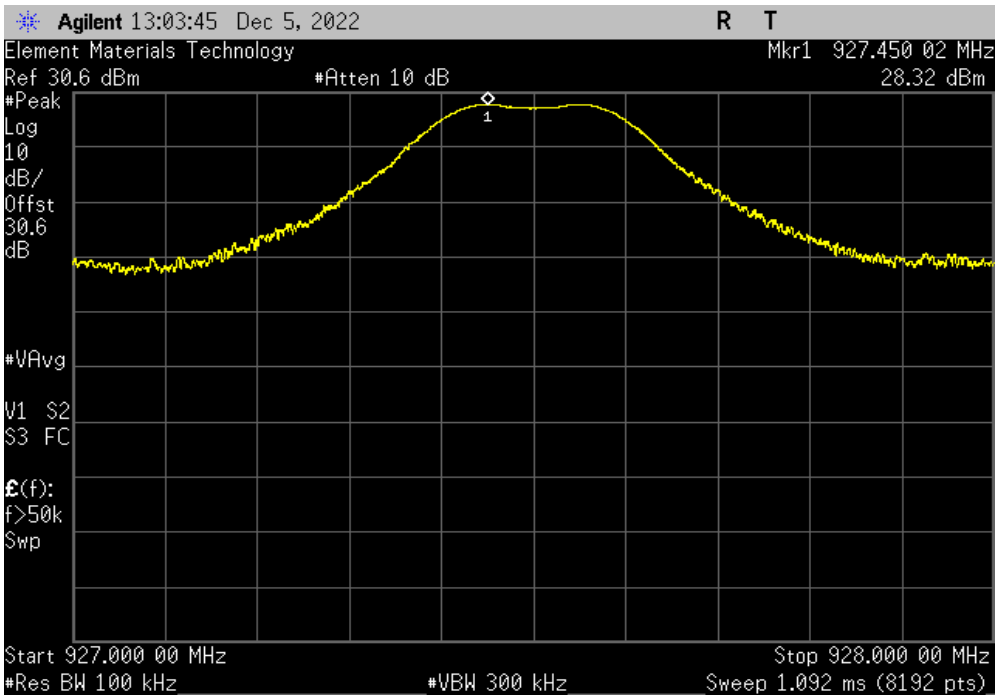
Single Channel - High Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental		915.25	N/A	N/A	N/A



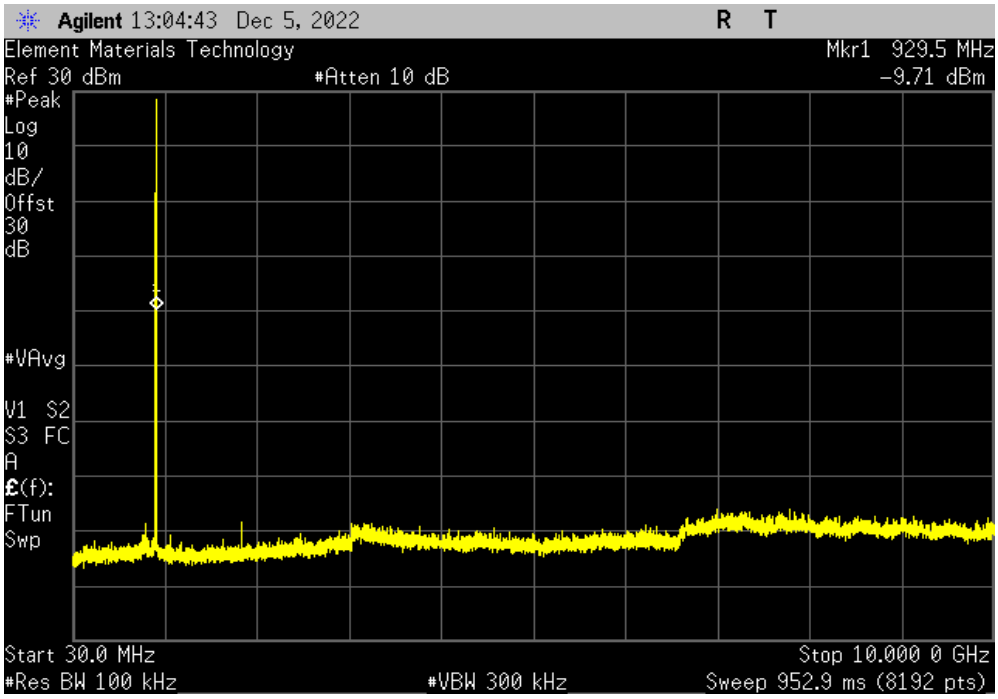
Single Channel - High Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz	1830.2	-68.41	-20	Pass



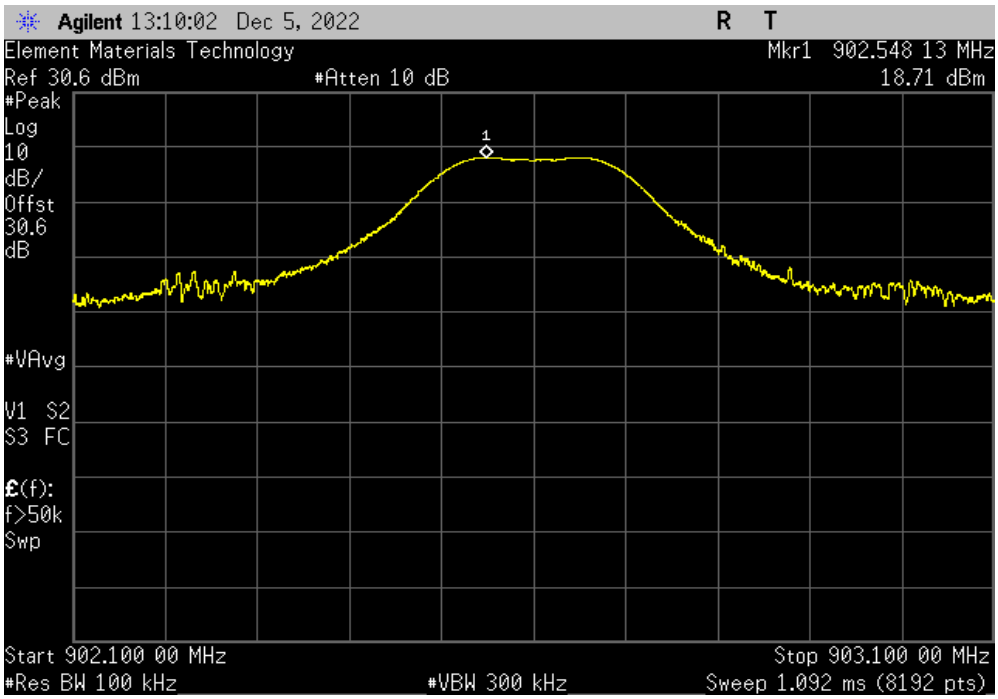
Single Channel - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental		927.45	N/A	N/A	N/A



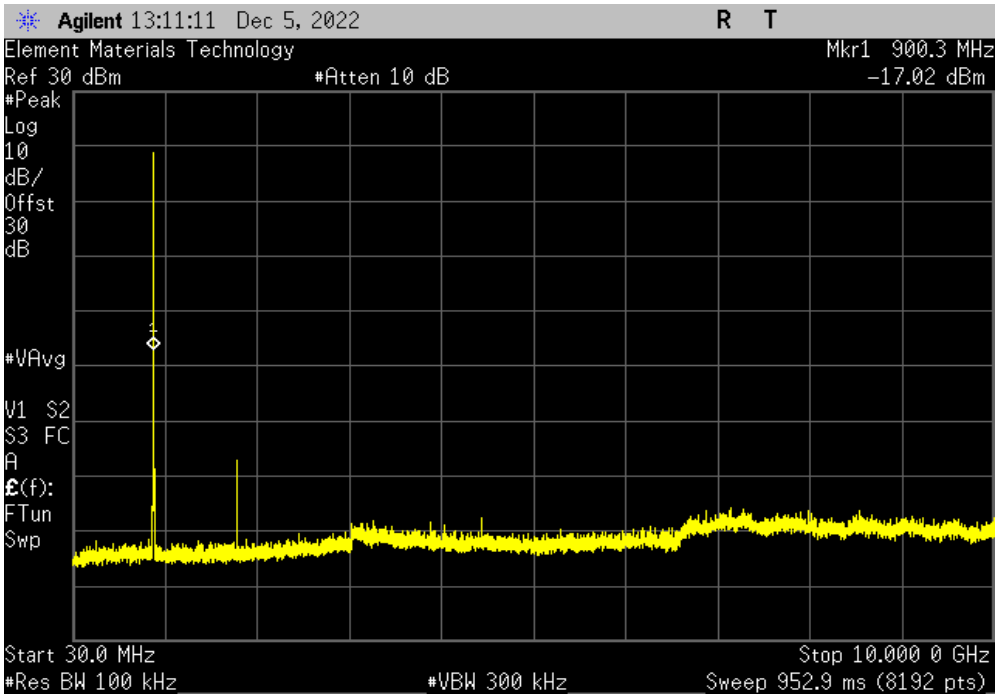
Single Channel - High Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz	929.5	-38.03	-20	Pass



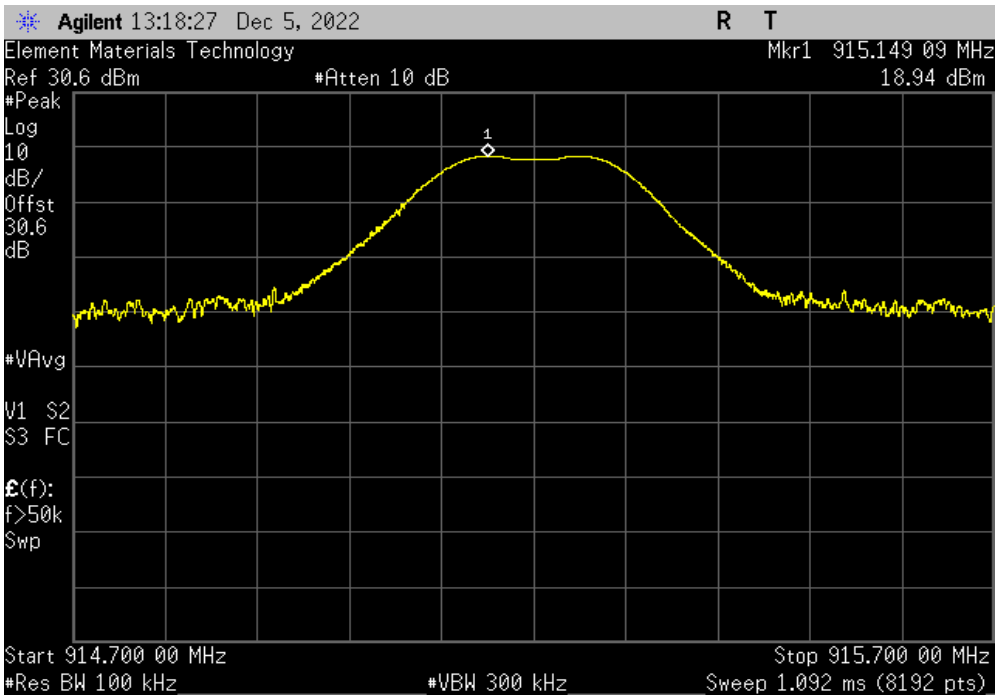
Single Channel - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz						
	Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental		902.55	N/A	N/A	N/A



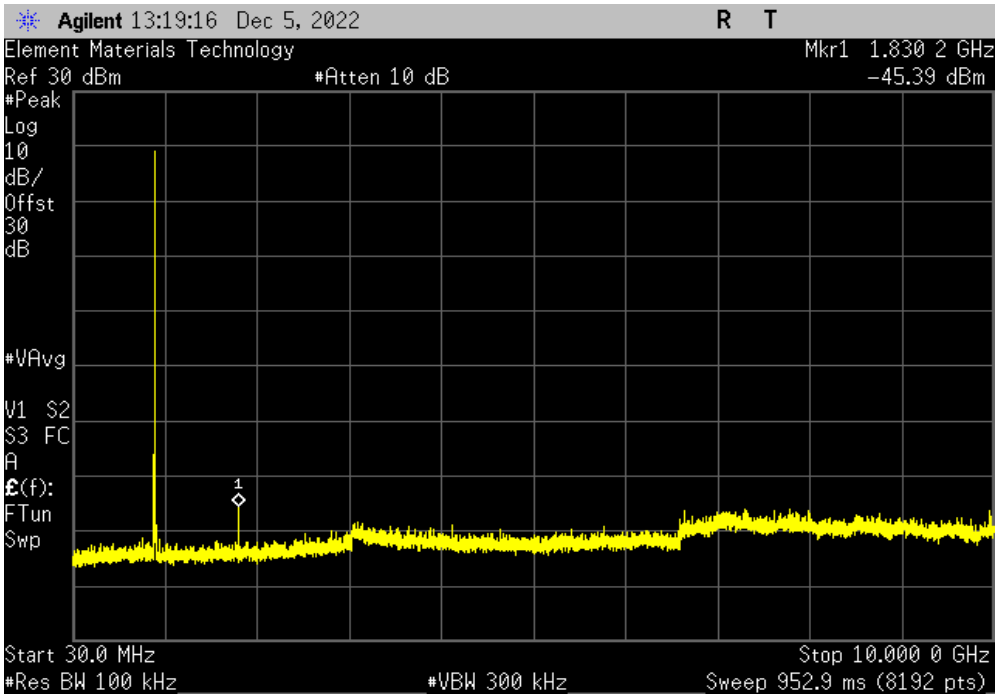
Single Channel - Low Power Mode, GFSK, 200 kbps, Low Channel, 902.6 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz	900.3	-35.73	-20	Pass



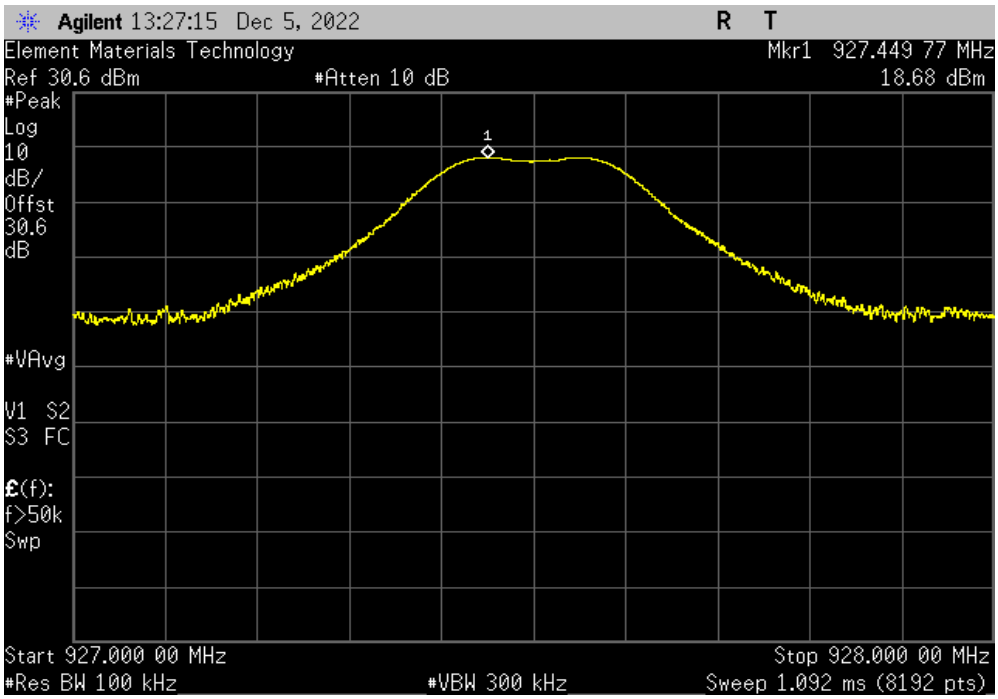
Single Channel - Low Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	915.15	N/A	N/A	N/A



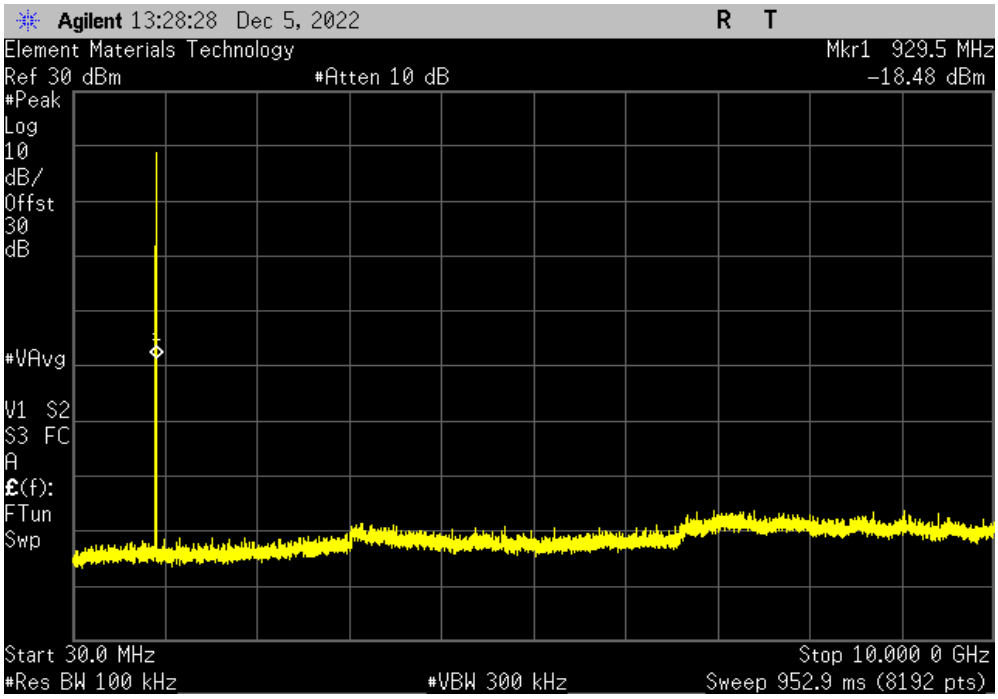
Single Channel - Low Power Mode, GFSK, 200 kbps, Mid Channel, 915.2 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz	1830.2	-64.33	-20	Pass



Single Channel - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental		927.45	N/A	N/A	N/A



Single Channel - Low Power Mode, GFSK, 200 kbps, High Channel, 927.5 MHz				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 10 GHz	929.5	-37.17	-20	Pass



End of Test Report